

MECHANIX ILLUSTRATED®

15^c

November

Jet Pilots Fly In
Bed—Page 70

ROCHESTER, N.Y.—GOLD RUSH CITY FOR INVENTORS
COMPLETE PLANS FOR A 35-MPH OUTBOARD RACEABOUT

ROAD TESTS ON '58 CHEVROLET, FORD, PLYMOUTH

POPULAR MECHANICS

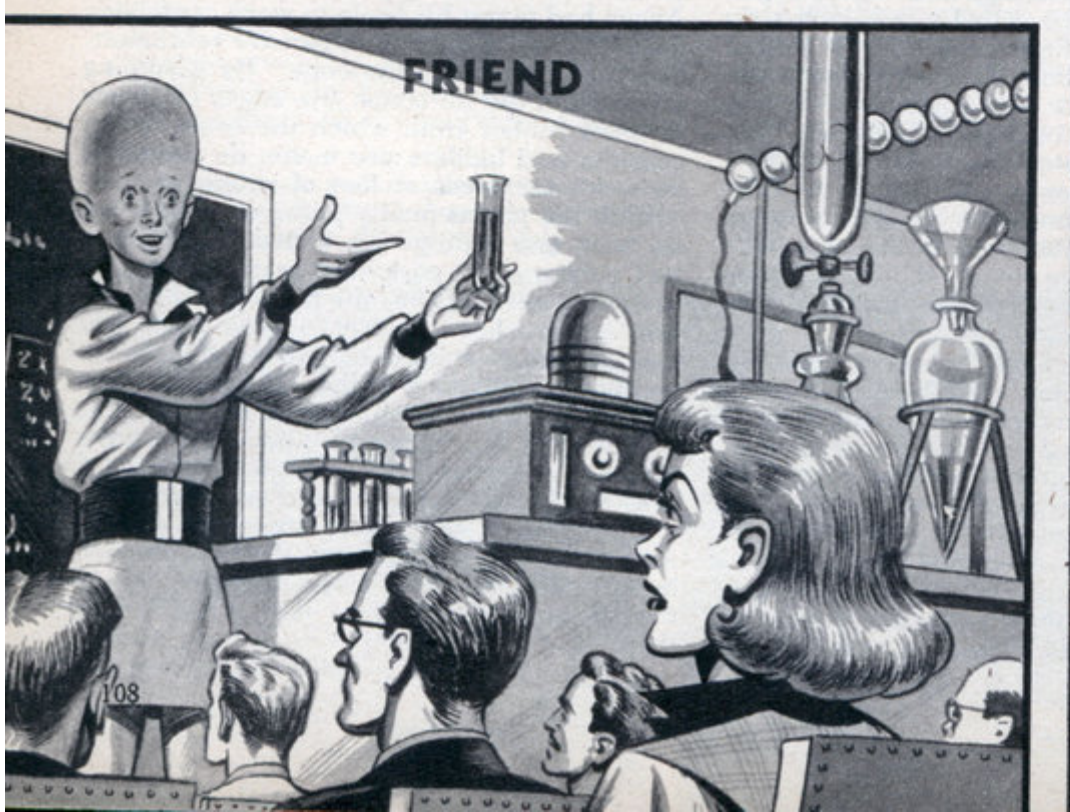
MACHINE

JANUARY 1958
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Belgium's Atomium
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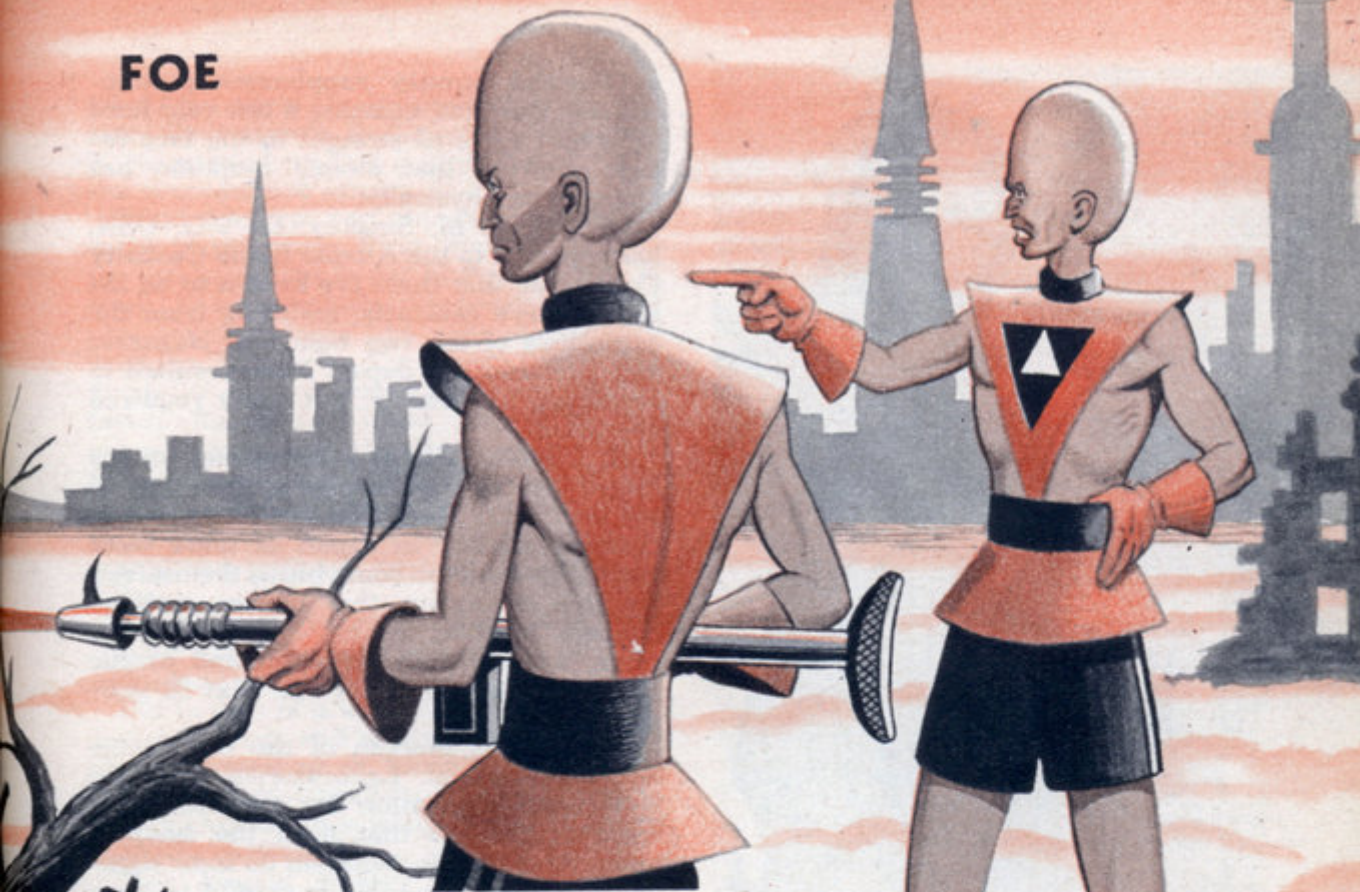


How Nuclear Radiation Can Change Our Race



KURT P.
SCHAFFENBERGER'S

FOE



**An atomic war could produce an
entirely new species of man.**

Would he be friend—or foe?

By O. O. Binder

"Now hear this, Earth! I am Mutant Man, Homo Superior! I have been created by radiation forces out of the loins of you, the human race, after your great and terrible Atom War. Yes, I am a step above and beyond you and I am now your master for better or for worse. You created me in your blind, savage, senseless war of atomic radiation. You have only yourselves to blame if I turn out to be your—Frankenstein Monster!"

WILL this voice someday thunder ominously over the world from a Mutant Man, not a human being, but as far beyond us as we are beyond the ape man? Will a new race, spawned out of the hellish radiation of a world-wide Atomic War, go on to challenge mankind's supremacy on Earth?

Shrug this off if you can or laugh at it



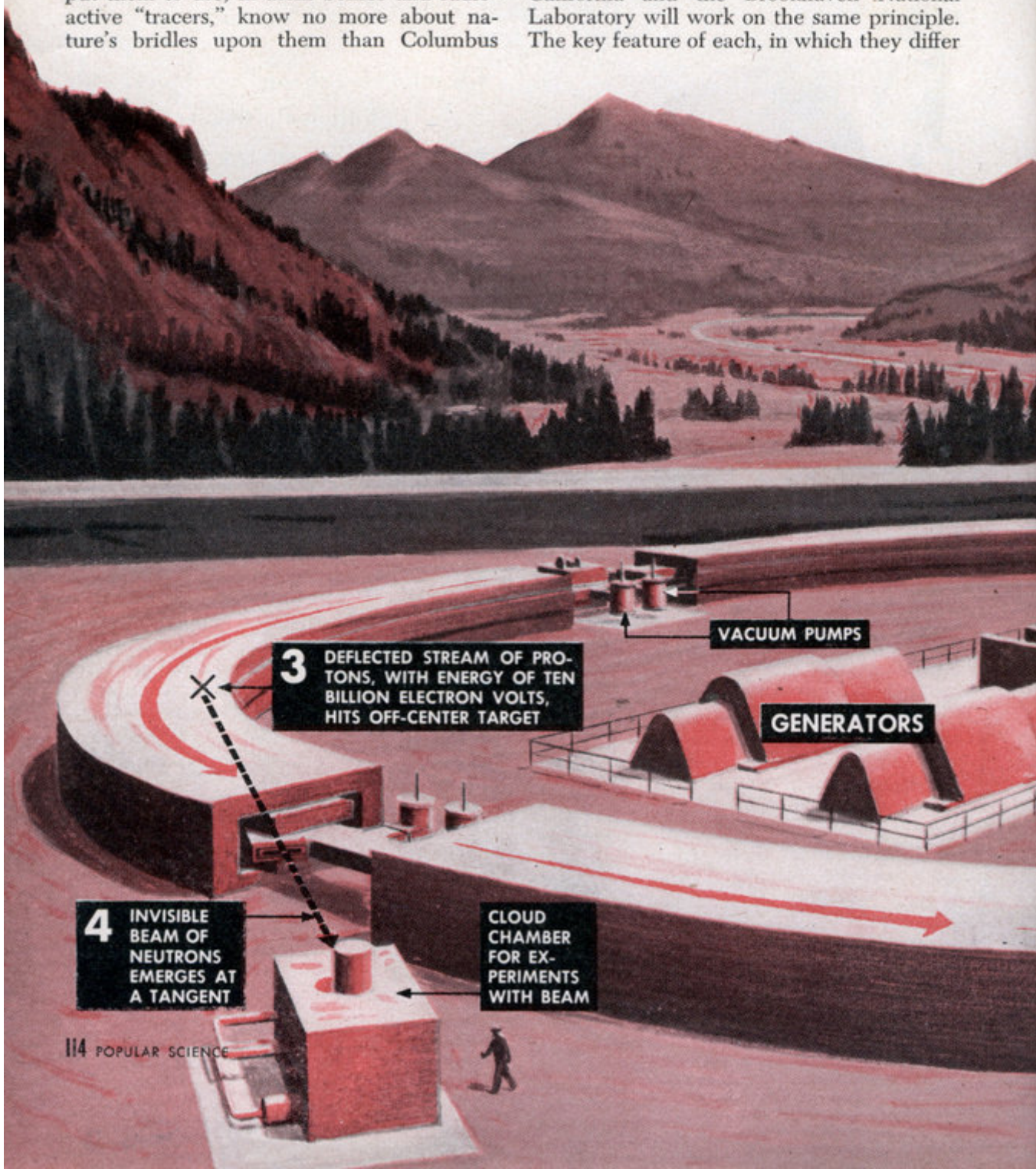
ators. He uses them to speed up atomic projectiles, with which he can then shatter other atoms, and he does it for exactly the same reason that a small boy socks an alarm clock with a hammer—to find out what's inside it and how it works.

Some of an atom's "innards," positively charged particles called protons, account for the difference between chemical elements. Their uncharged partners, the neutrons, account for the instability of some atoms and the stability of others. Hence these strange particles are extremely important in science, politics, and economics. Yet even those who put them to use, in atom bombs and radioactive "tracers," know no more about nature's bridles upon them than Columbus

knew about America when he sailed westward in 1492.

Why do the physicists want more powerful atom smashers? They want to learn more, for one thing, about the mysterious glue or "binding energy" that holds charged particles like protons together, when by all the old rules they should fly apart. And they want to test their conviction that *energy* can be turned into *matter*, just as surely as atom bombs turn *matter* into *energy*.

The 10-billion-volt atom smashers projected independently by the University of California and the Brookhaven National Laboratory will work on the same principle. The key feature of each, in which they differ

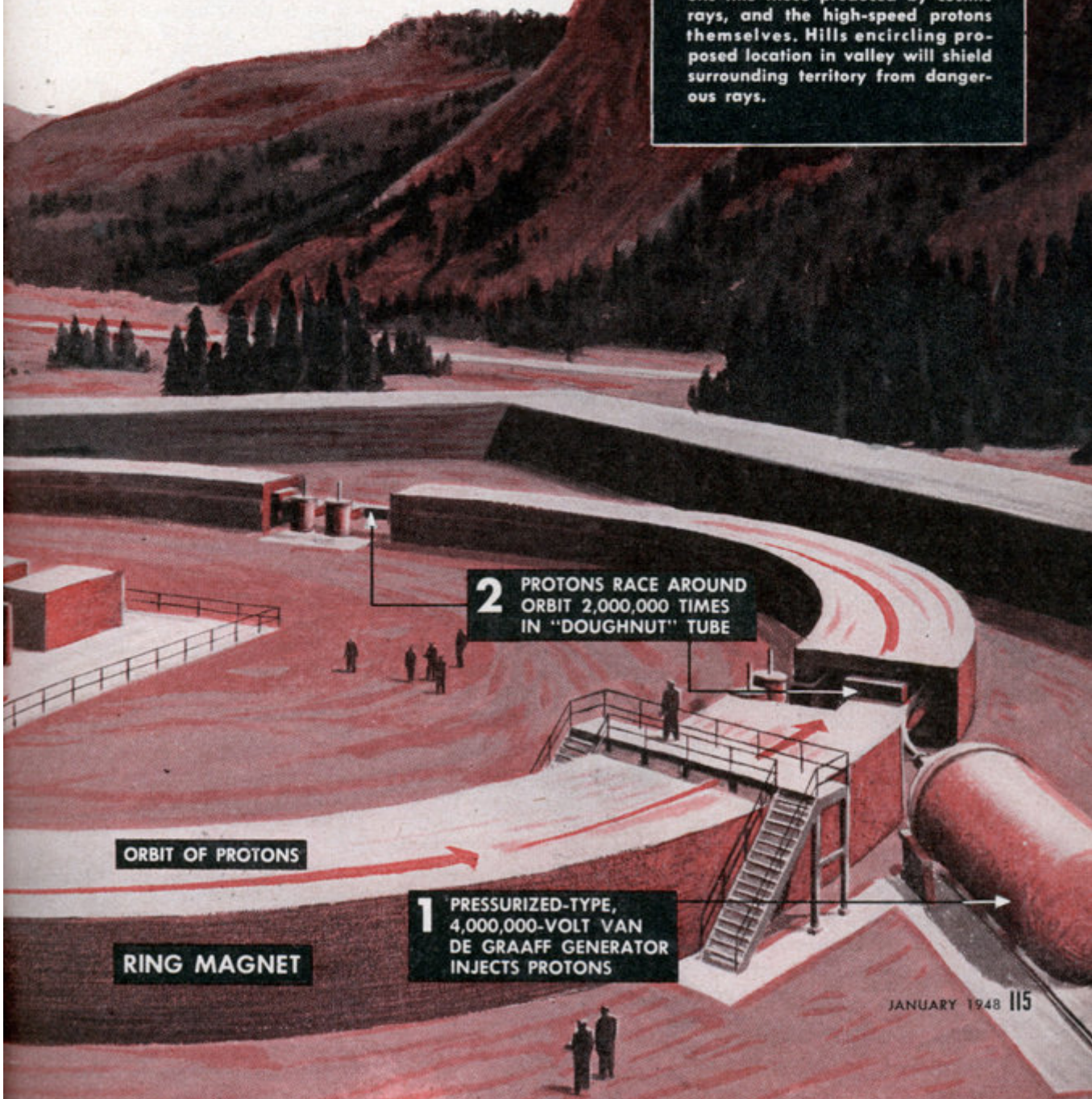


from today's biggest machines, will be a gigantic ring-shaped magnet. Like the fence that keeps horses within a race track, the ring magnet will restrain atomic particles to a circular orbit, enabling them to be accelerated to fantastic speed and energy within a vacuum tube of practicable length.

The atomic projectiles will be obtained by stripping the electrons from atoms of hydrogen. This can be done by discharging an electric arc in hydrogen gas. Protons, the charged cores of hydrogen atoms, are left.

These protons will be catapulted into a "doughnut" or circular vacuum tube built into the ring magnet. The device that gives the protons a running start will be a 4,000-000-volt electrostatic machine called a Van

THE MIGHTY BEVATRON, 10-billion-electron-volt atom smasher, will be 50 times as powerful as today's biggest. To give clear view of construction, drawing omits all-weather housing. Giant ring magnet, most prominent feature of machine, holds atomic particles on a circular course so they can be boosted to fantastic speed and energy within a vacuum tube of practicable length. Arrangement shown is for experimenting with beam of neutrons, produced by collision of racing protons with metal target. Other particles available for experiment may include man-made mesons like those produced by cosmic rays, and the high-speed protons themselves. Hills encircling proposed location in valley will shield surrounding territory from dangerous rays.

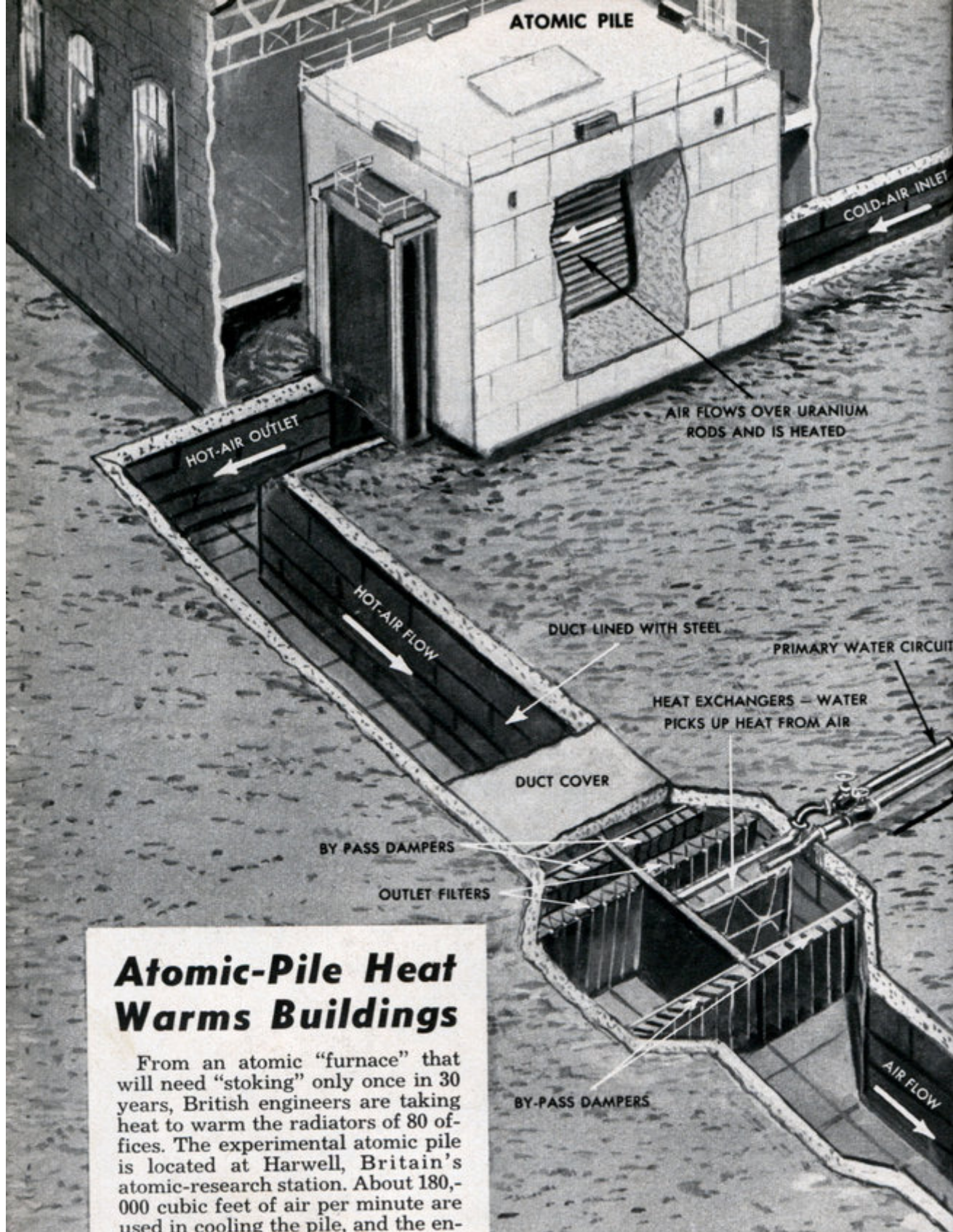


2 PROTONS RACE AROUND ORBIT 2,000,000 TIMES IN "DOUGHNUT" TUBE

ORBIT OF PROTONS

RING MAGNET

1 PRESSURIZED-TYPE, 4,000,000-VOLT VAN DE GRAAFF GENERATOR INJECTS PROTONS



Atomic-Pile Heat Warms Buildings

From an atomic "furnace" that will need "stoking" only once in 30 years, British engineers are taking heat to warm the radiators of 80 offices. The experimental atomic pile is located at Harwell, Britain's atomic-research station. About 180,000 cubic feet of air per minute are used in cooling the pile, and the engineers decided this hot air could be put to work heating near-by buildings. Now the high-temperature air is passed through heat exchangers which transmit the heat to water. The heat is transferred to a secondary circuit which passes through conventional radiators in the buildings.

AIR-INLET FILTERS

BUILDINGS HEATED BY ATOMIC PILE

PUMP

RADIATORS

SECONDARY
WATER CIRCUIT

USED AIR DISCHARGED
UP 200-FOOT STACK

G. H. LAYTON
1952

CROSS SECTION OF ATOMIC PILE

LEAD DOOR

GRAPHITE

CONCRETE

BISMUTH

AIR-OUTLET
VALVES

URANIUM RODS
AND CHANNELS

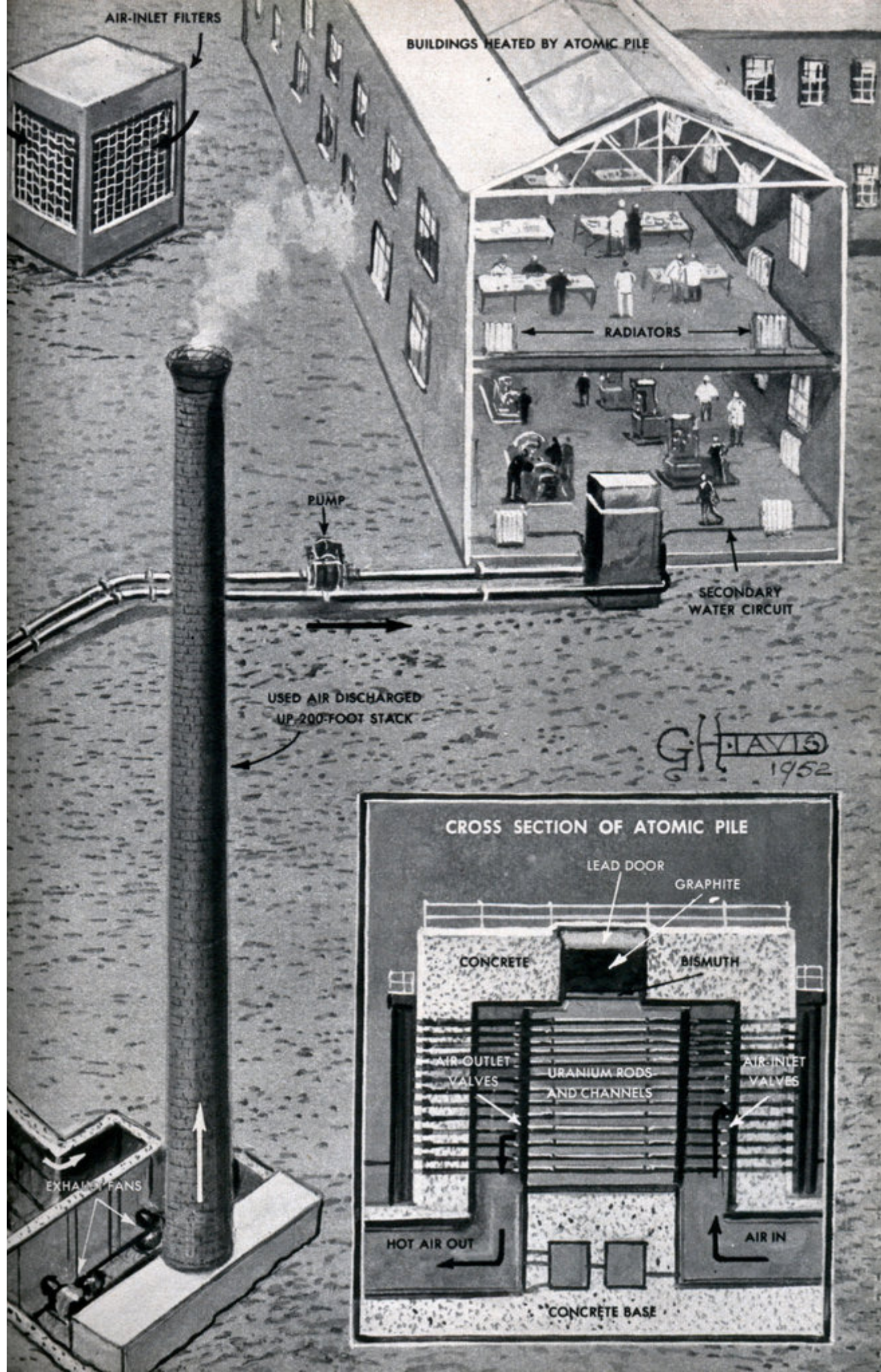
AIR-INLET
VALVES

HOT AIR OUT

AIR IN

CONCRETE BASE

EXHAUST FANS



How to Run An Atomic Power Plant

Nuclear research piles give preview of methods that may be used to make tomorrow's electricity.

By Martin Mann

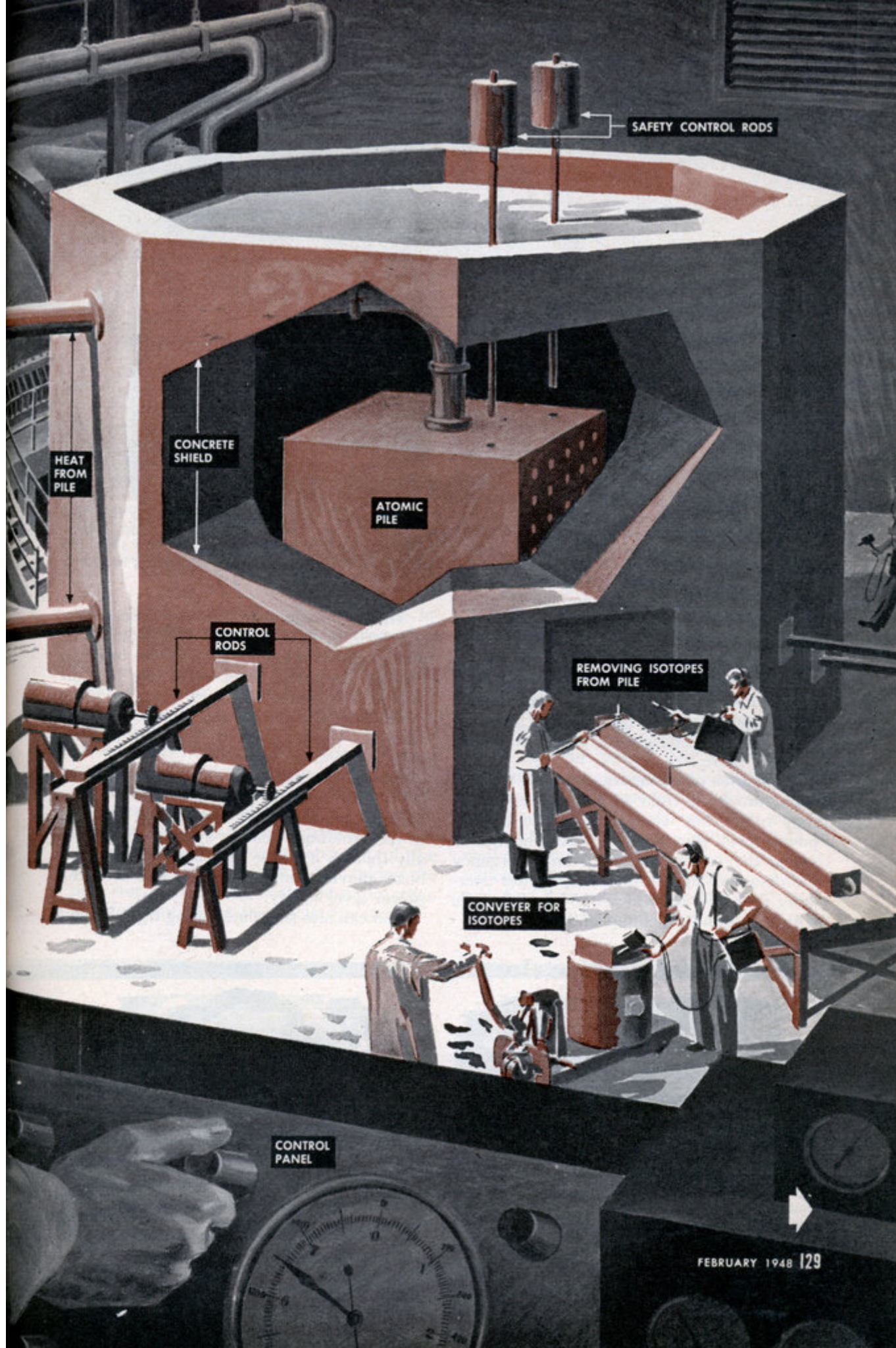
You—as a citizen—own a part of the 2½-billion-dollar atomic-energy industry. Although your individual share is only one in 143,000,000, it is probably the most important single thing you own. It provides the most powerful weapon in our arsenal for war, promises cures for many diseases, and will eventually furnish cheaper electricity and transportation.

YOU'VE heard a lot about atomic energy. But you probably have a lot of questions because so few people have actually seen an atomic engine. Well, I have. I was one of a small group of reporters who saw two nuclear piles early this winter. While they were operating, I touched them, stood on top of one, saw it turned on and off, watched as "hot" radioactive materials were taken out of it. So maybe I can help you visualize the process and get rid of some of the mystery.

Let's imagine you have just gotten a job running an "atom furnace." Sure I mean you! Some day such jobs will be as common as locomotive engineers. The engines of the future will be like the experimental piles I saw at the Argonne National Laboratory, which the University of Chicago runs for the U. S. Atomic Energy Commission.

Atomic power plant of future may look like this drawing. Some shielding omitted to show details.





SAFETY CONTROL RODS

HEAT FROM PILE

CONCRETE SHIELD

ATOMIC PILE

CONTROL RODS

REMOVING ISOTOPES FROM PILE

CONVEYER FOR ISOTOPES

CONTROL PANEL

POPULAR NOVEMBER 1950 MECHANICS

WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 94 NO. 5

TV's LITTLE BROTHER

By Creighton Peet

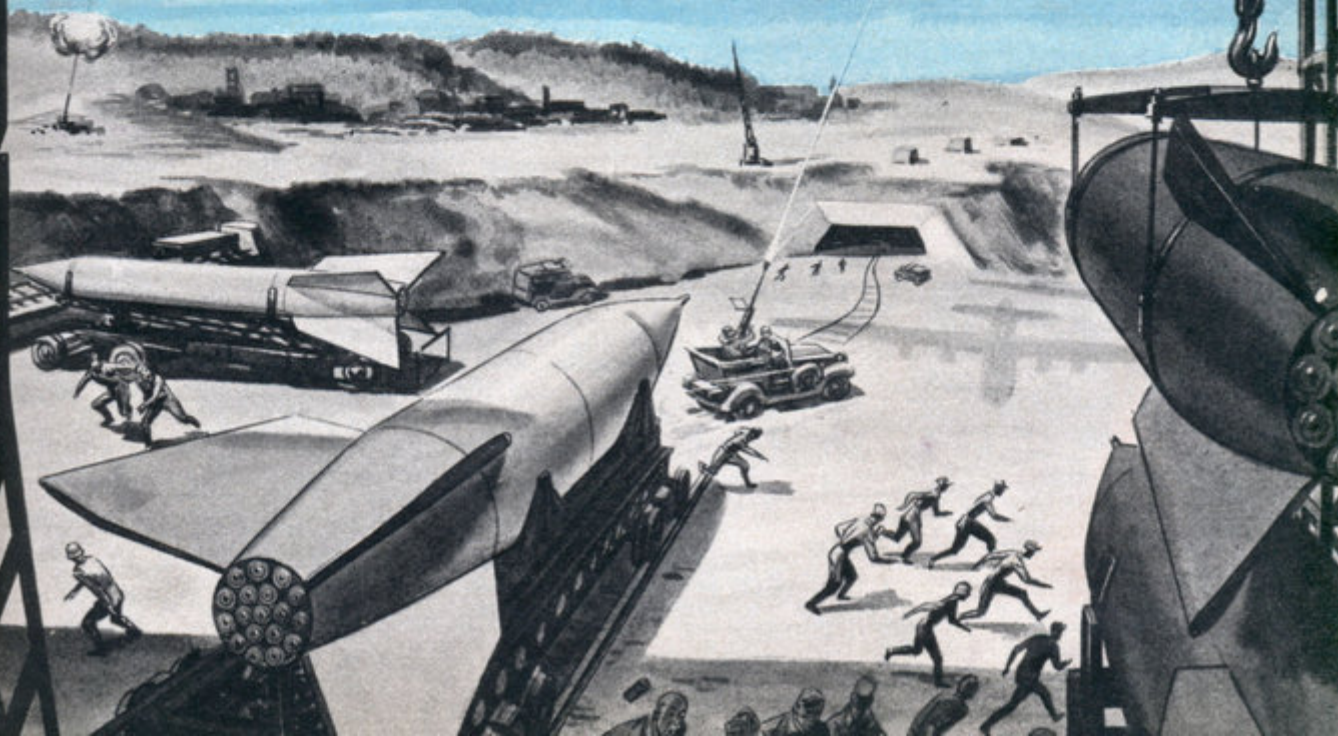
YOU CAN use it for anything—absolutely anything. It will show you what's going on around corners, through walls, underwater, in the dark, at the bottom of an oil well—or inside the human stomach.

It's TV's little brother, a small and comparatively inexpensive wired television setup designed for industrial uses. Already three such devices are on the market. Diamond Power Specialty, a subsidiary of I. T. & T. has the Utiliscope; Remington Rand has developed its Vericon, and RCA the Vidicon. In one model the orthicon tube is the size and shape of a small flashlight, and its housing looks like a 16-mm. home movie camera.

Among the hundreds of uses to which such tubes have been, or could be, put, a few are: watching a machine in a factory, a flame under a boiler and a water gauge at the top of a giant boiler.

They also guard prison corridors, or keep an eye on a jewelry counter in a store. They can be used to check progress along an assembly line, or the density of traffic at critical intersections. One operator, one

When Nazi V-2 nests defied block-busters, bombers loaded with explosives and camera in nose were steered to hangar by mother plane with TV receiver



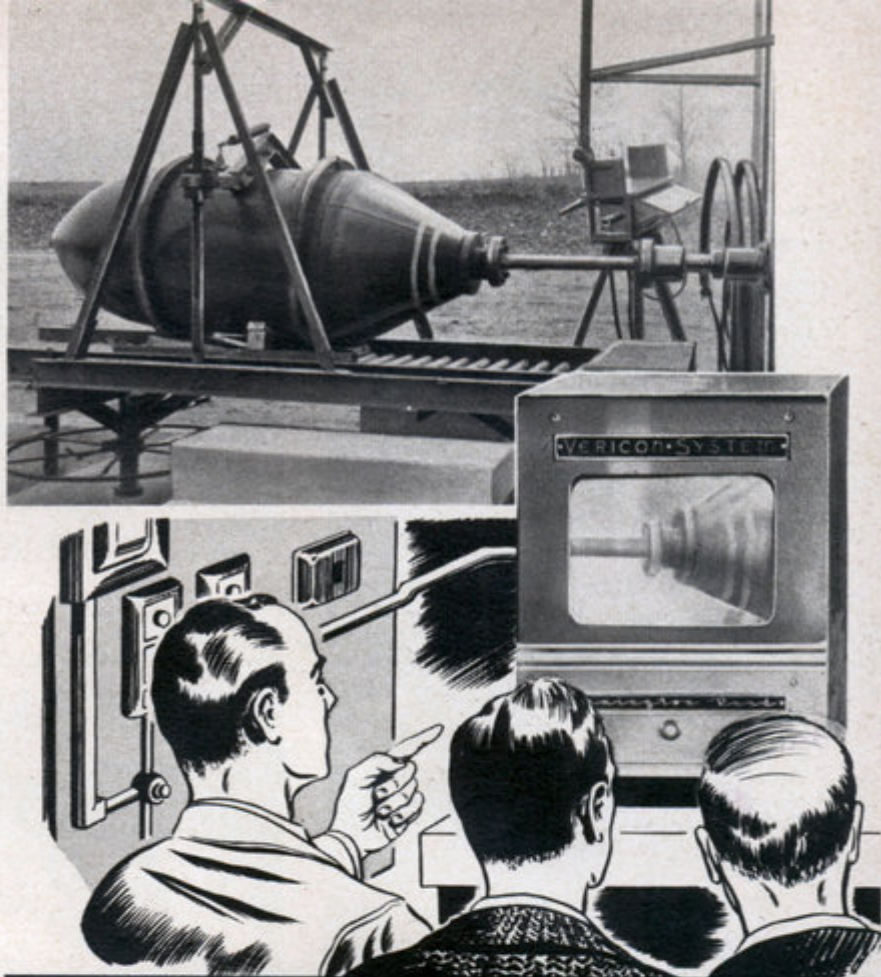
exactly how much material he had picked up.

Still another use of the Utiliscope is in the steel industry, in the B & W Tube Works, of Beaver Falls, Pa. Here a camera equipped with a telephoto lens is used to watch the surface of molten metal in a continuous casting process. This eliminates the need of a man standing close to the casting pipe.

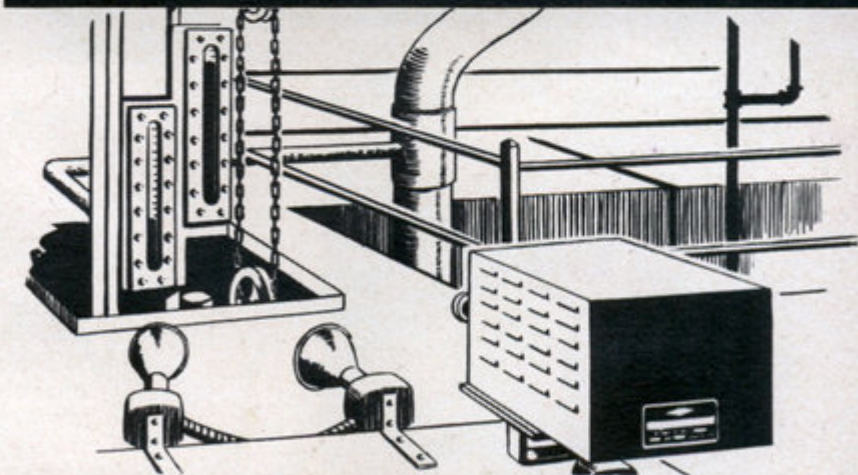
While standard broadcast television has about 525 scanning lines, the Utiliscope picture has but 220 lines. The resulting picture is not quite as clear as that on your home set, but is entirely adequate for the vast majority of industrial applications, and cameras and viewers can be connected with ordinary cables instead of coaxials. The picture will carry about 500 feet without booster equipment, farther with it, and as many as 10 viewers can be connected with one camera. The total cost of one complete Utiliscope installation is between \$3000 and \$3500.

Remington Rand's Vericon, developed under William L. Norvell, chief of the Guided Missiles Branch in Air Communications as a lieutenant colonel during the war, has found its chief uses so far in military and defense plants, and the observing of surgical operations. The Vericon uses a standard 525-scanning-line picture and a coaxial cable. A complete unit runs to about \$8500.

More than a score of Army ordnance depots around the country are also equipped with these little TV eyes to make the defusing and disassembling of various types of ammunition safer. Personnel located in a concrete bunker half a mile away can defuse a bomb



Defusing of a bomb, top, is about to begin under observation of camera while, safely within a concrete shelter, technicians watch the operation. Below, gauge on drum of steam boiler builds up to 1400 pounds' pressure under the watchful eye of an engineer who is safe in remote office



IF THE A-BOMBS BURST--

Here is what to expect,
what you can do today to prepare yourself,
what you can do then to survive

By Clifford B. Hicks

Part I

8:15 a.m., August 6, 1945. A single plane flies over the city. The only warning is a blinding flash of light. A ball of fire explodes in the sky, hanging there for a moment as it grows in size and fury. Then in a crackling instant the world's second atomic explosion races down to strike the earth at a spot called Hiroshima.

Sixty seconds later 70,000 Japanese are dead, caught above ground. The heart of the city has been blasted into rubble which still plummets down on the dead and dying.

10:15 a.m., January 2, 1950. A stenographer in Manhattan shrugs her shoulders over her mid-morning cup of coffee and says to her girl friend, "I'm tellin' you, there's nothing you can do to save yourself

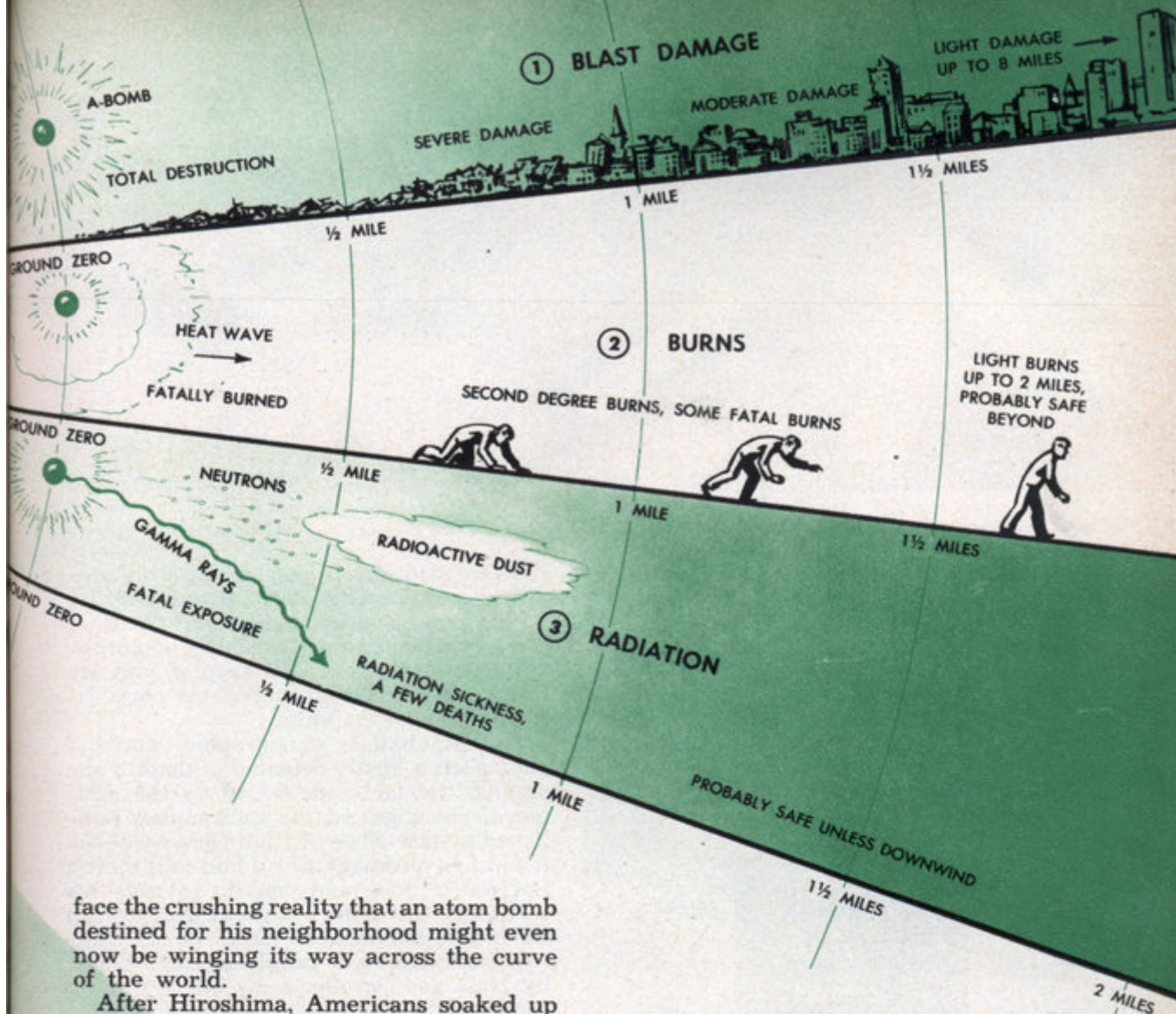
—just one bomb will wipe out New York. Me, I'm headin' for the country if things get worse."

At the same moment the sky above Chicago's Loop is split by a bright flash of lightning from a sudden winter storm. A nervous executive freezes in terror for an instant, then smiles sheepishly as he returns to the morning mail. But he can't help wondering whether the bomb would demolish his home and kill his family in a suburb 14 miles away.

Now, 4½ years after the atom bomb dropped toward its first target, the threat of a nuclear fireball hangs over every major American city. The residents of New York or Gary, Washington or San Francisco must

Japanese landscape: Main Street, Hiroshima, shortly after the first atomic air burst. Reinforced concrete withstood blast the best





face the crushing reality that an atom bomb destined for his neighborhood might even now be winging its way across the curve of the world.

After Hiroshima, Americans soaked up the idea that they owned a superweapon. "There's no defense." Now, the Manhattan stenographer and the Chicago suburbanite shrug their shoulders in resignation. They are victims of a distorted belief that an entire city can disappear in a whiff of nuclear fission. If a bomb drops, the city dweller figures, there's little he can do to save himself or his family.

There are a great many things he can do.

Hundreds of scientists, under guidance of the Atomic Energy Commission, have been groping into the unknown since 1945, working toward a realistic appraisal of the bomb. With full respect for the awesome power of the weapon, they have found that:

No big city will disappear in the burst of one Hiroshima-type bomb.

There is much less danger from radiation than originally supposed.

Shelters are effective. (In Nagasaki, a few hundred people who were in tunnels almost directly beneath the burst of the A-bomb are alive and healthy today.)

Blast, burns and radiation cause all the casualties in an A-bomb burst. In diagram above, the legends show the effect of each of these three dangers at various distances from ground zero. Whether you live or die depends upon your location and protection



be killed by gamma rays—but this, again, is the radius of complete blast destruction and fatal burns. The danger from gamma rays falls off rapidly with distance. Although there might be a good many cases of radiation sickness beyond $\frac{3}{4}$ mile, there would be few fatalities.

Neutrons, the split particles of atoms, also cause death. They render radioactive the materials they strike, but they haven't the driving penetration of gamma rays. They are effective only at shorter distances, so anyone protected from gamma rays also is protected from neutrons.

Fission products from the bomb can contaminate an area. This is the radioactive dust which settles down from the bomb and is called the "fall out." Man can survive a certain amount of exposure to these particles, but he can't work near them for long periods. A "lethal dose" is gradually built up in his body.

The big danger is that these particles from the fall-out will enter the body through the nose, mouth or open wounds. Inside, they continue to emit radioactivity until the lethal dose has been achieved—and the man dies.

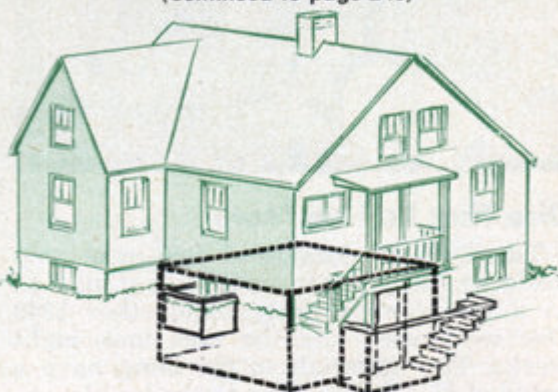
It is significant that these three effects of the bomb—blast, burns and radiation—all reach out to a danger limit, on the sur-

face, of no more than two miles. Beyond that, except for freaks of coincidence, a man's chances of surviving are excellent even though he may be above ground.

Because distance is man's best protection, the first question anyone should ask is "How close am I to an A-bomb target?"

According to one estimate, an atom bomb costs from \$1,000,000 to \$5,000,000. These blue-chip weapons won't be wasted on poor targets. The National Civil Defense Office considers you a potential A-bomb victim if you live in one of the critical target areas which have been designated.

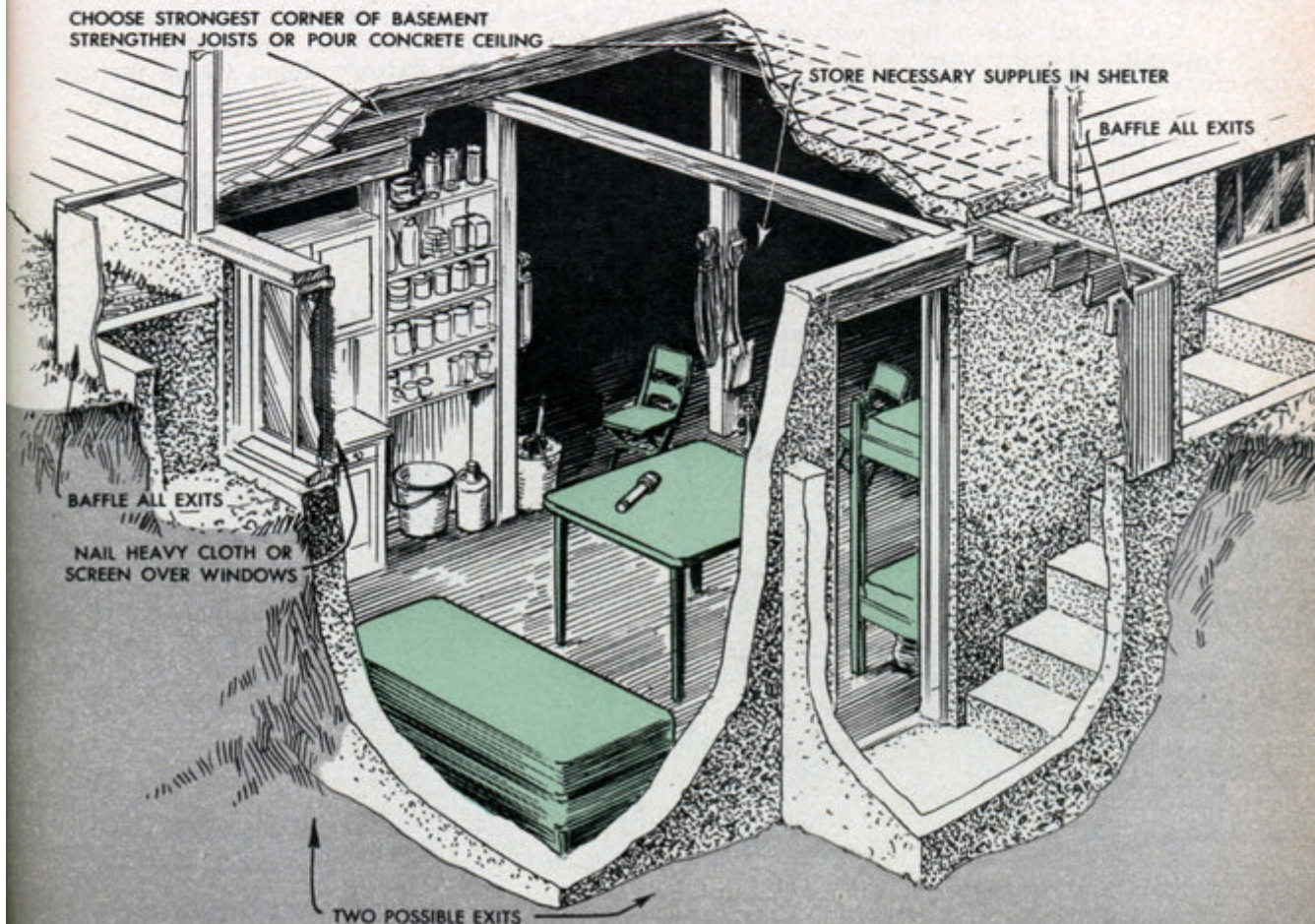
(Continued to page 248)



Bomb shelter in the basement of a home affords some protection. If a concrete ceiling can't be poured, the overhead joists should be strengthened. Shelter should be stocked with equipment, food and water

PREPARE YOUR BOMB SHELTER

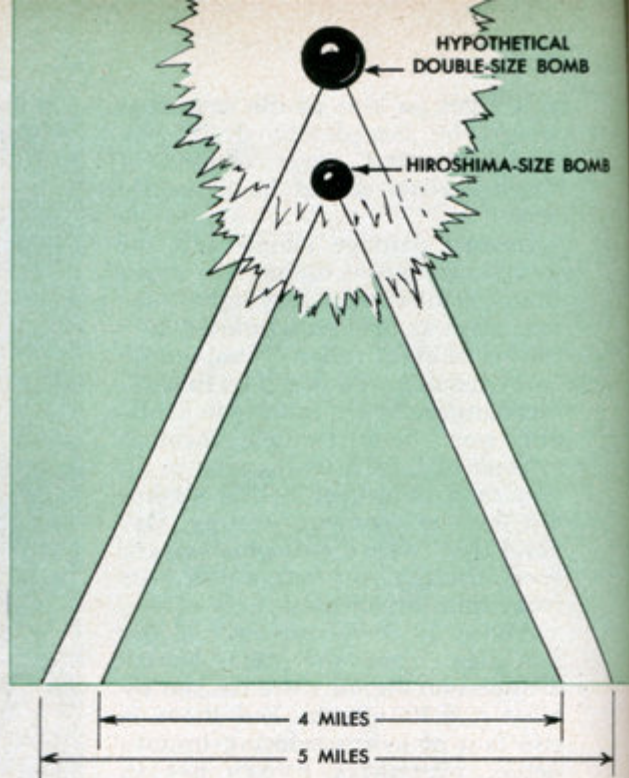
CHOOSE STRONGEST CORNER OF BASEMENT
STRENGTHEN JOISTS OR POUR CONCRETE CEILING



BAFFLE ALL EXITS

NAIL HEAVY CLOTH OR
SCREEN OVER WINDOWS

TWO POSSIBLE EXITS



Fashion plate, Atomic Age. Monitoring team, wearing protective clothing, checks radioactivity in a rehearsal with Geiger counters. Diagram shows that doubling size of bomb won't double its diameter of destruction

fatal in some cases. The temperature of the thermal wave falls off rapidly beyond a mile.

Radiation. This danger from the bomb has been overpublicized because it is unfamiliar. Though it caused many deaths in Japan, it was directly responsible for no

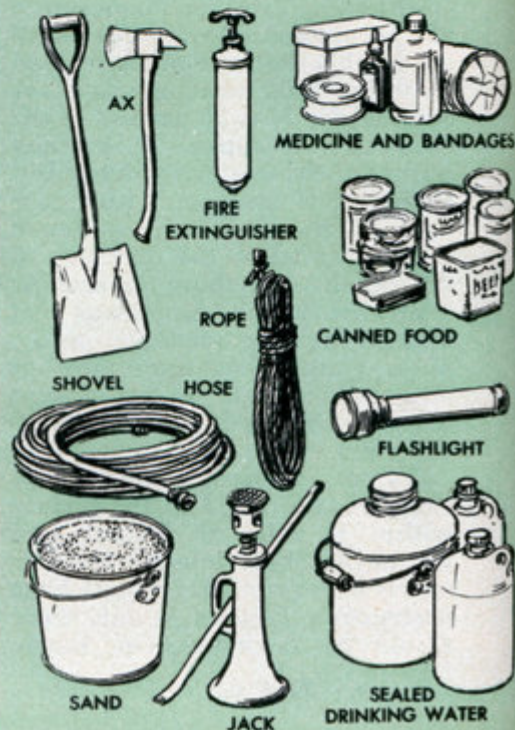
more than 15 percent of the total fatalities.

Three types of radiation can injure you: *Gamma rays* cause destruction inside the body. They have great powers of penetration but they can't render radioactive the material they penetrate. Unprotected persons within $\frac{1}{2}$ mile of ground zero would

In preparing a shelter, nail heavy cloth or wire screen across windows to cut down fragments of flying glass
Copyright IKKO Radio Pictures, Inc.



WHAT TO PUT IN YOUR SHELTER



you'll get an idea of the area that would be completely destroyed. Above ground, your chance of staying alive would be virtually zero.

Severe damage ranges out for a mile, moderate damage to more than 1½ miles, and very light damage, such as broken windows, to a radius of eight miles. Thus, a mile from ground zero you'll be in serious danger. At 1½ miles you probably won't be hurt unless, through a freak of fate, a wall caves in on you or a chunk of debris strikes out for the spot you occupy. Beyond that radius your chances are good, though you may suffer cuts from splinters of glass.

About 50 to 60 percent of the fatalities from the two bombs dropped on Japan were caused by blast and its effects. But there is one fact of overwhelming importance: virtually every person killed was above ground. At Hiroshima, the radar operator failed to sound the alarm because he thought the plane he spotted on his scope was only coming over for reconnaissance.

Burns. The bomb explodes in a ball of fire with a temperature of 1,000,000 degrees Centigrade. The ball actually is so hot that it heats the surrounding air to luminescence, just as a fluorescent light glows. From this comes the blinding flash.

Out from the ball of fire rolls a wave of thermal radiation—heat—which can raise the temperature of a person's skin 50 degrees Centigrade at a distance of more than ¾ mile. This searing wave accounted for 20 to 30 percent of the casualties in Japan. It literally burned the skin off its victims. But the wave of heat can't turn corners. All the flash burns in Japan were oriented to the direction of the bomb—anything in shadow from the bomb flash was not burned at any distance away. Many victims had their faces or arms burned right up to the point where their hats or sleeves came—and no farther.

It's virtually certain that anyone caught unprotected on the surface within ½ mile of ground zero would be fatally burned, but this also is the radius of complete blast destruction. Beyond ½ mile there would be second-degree burns,



Tons of masonry are dropped on a British shelter to test it. British civil-defense officials believe that a shelter of this type, or the "Anderson" shelter shown below, when covered by three feet of earth could protect a man very close to ground zero



ROAD TESTS ON '58 CHEVROLET, FORD, PLYMOUTH

POPULAR MECHANICS

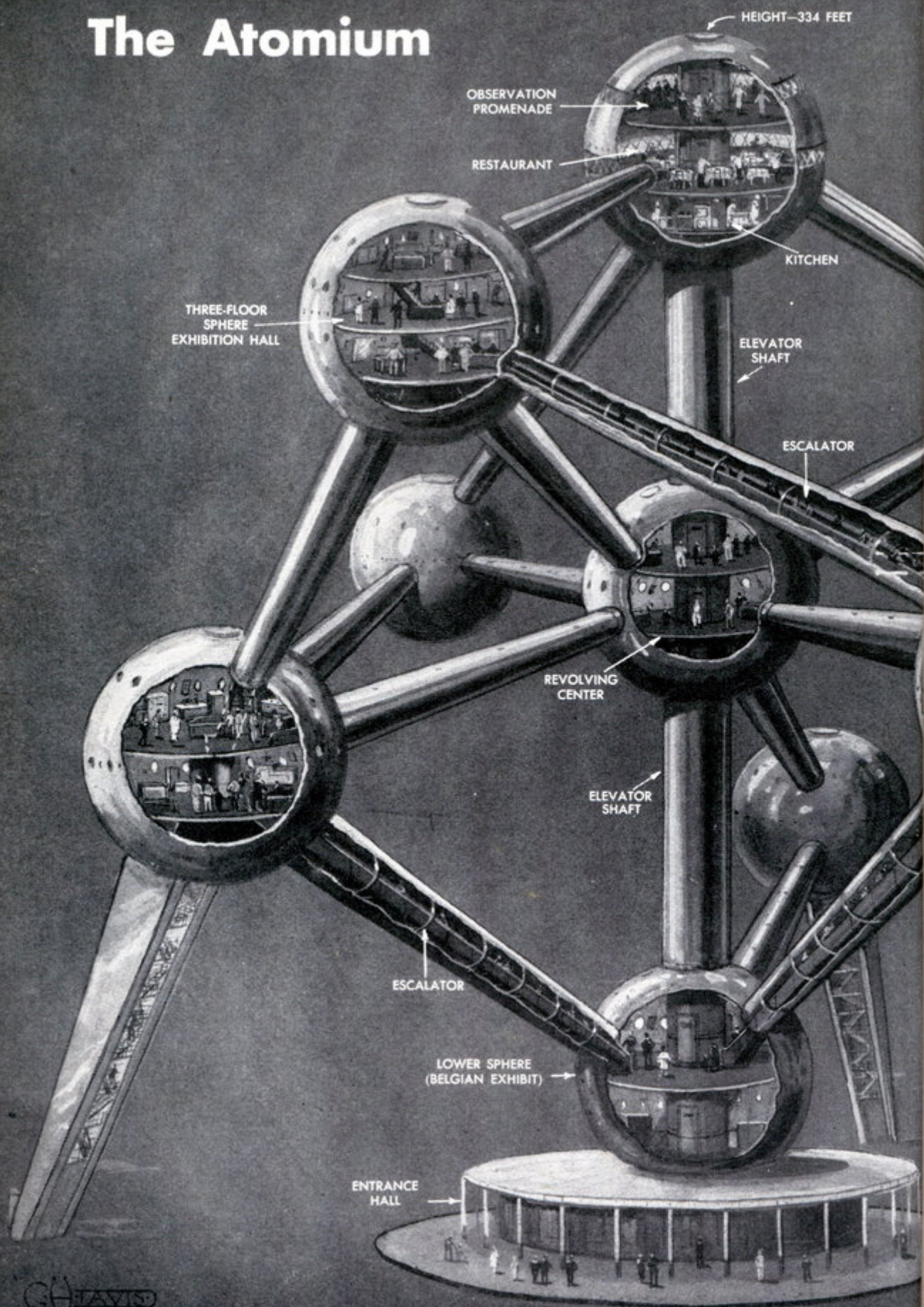
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Belgium's Atomium
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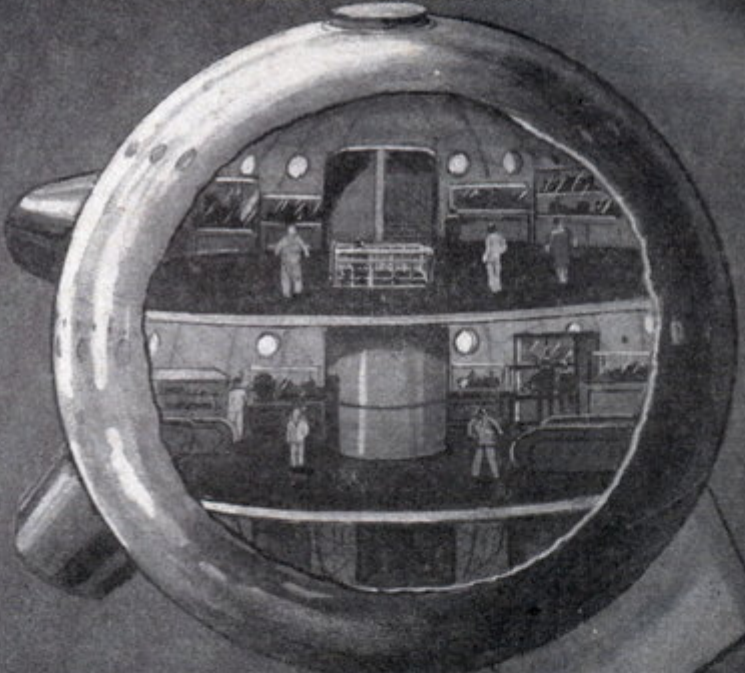


The Atomium



G. H. LAVIS
BRUSSELS
1957

SECTION OF TWO-FLOOR SPHERE

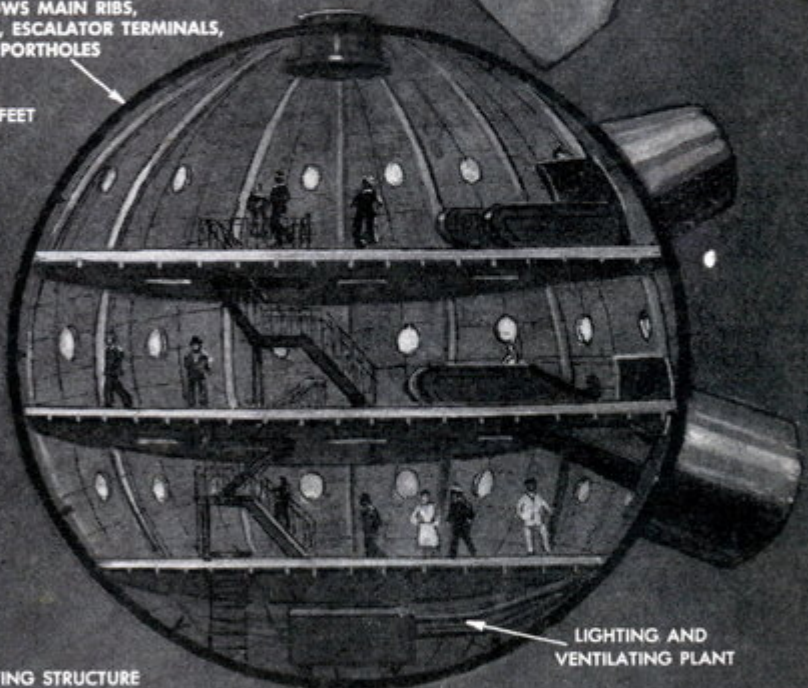


STAIRWAYS
INSIDE SHAFT

CAFE OR
EXHIBITION
HALLS

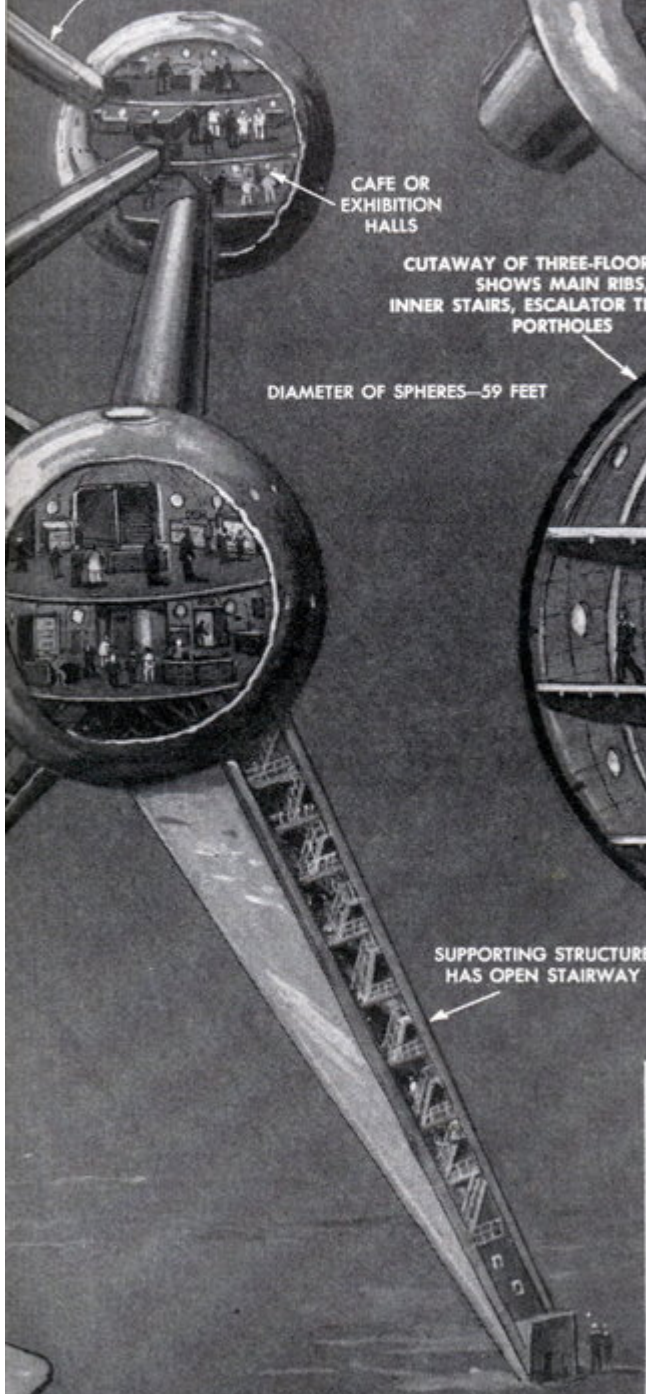
CUTAWAY OF THREE-FLOOR SPHERE
SHOWS MAIN RIBS,
INNER STAIRS, ESCALATOR TERMINALS,
PORTHOLES

DIAMETER OF SPHERES—59 FEET

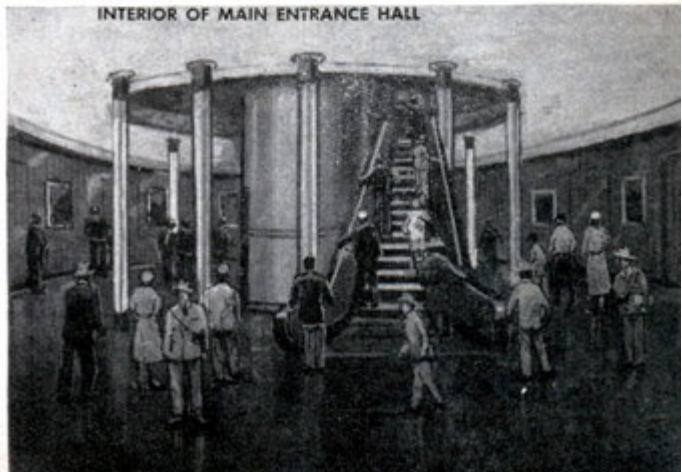


LIGHTING AND
VENTILATING PLANT

SUPPORTING STRUCTURE
HAS OPEN STAIRWAY



INTERIOR OF MAIN ENTRANCE HALL



Has Russia the Atom Bomb?



BY HANSON W. BALDWIN
Military Analyst, New York Times;
Graduate, U. S. Naval Academy

DOES Russia have the atom bomb?

Soviet Foreign Minister Molotoff and his mouth-piece Vishinsky have stated that the Russians know the "secret" of the bomb.

They undoubtedly do, but that does not mean that Russia has been able to build a bomb. In my opinion they have not produced an atomic bomb to date of writing—but they will. Intelligence information—unofficial and inconclusive but indicative—says "no bomb yet."

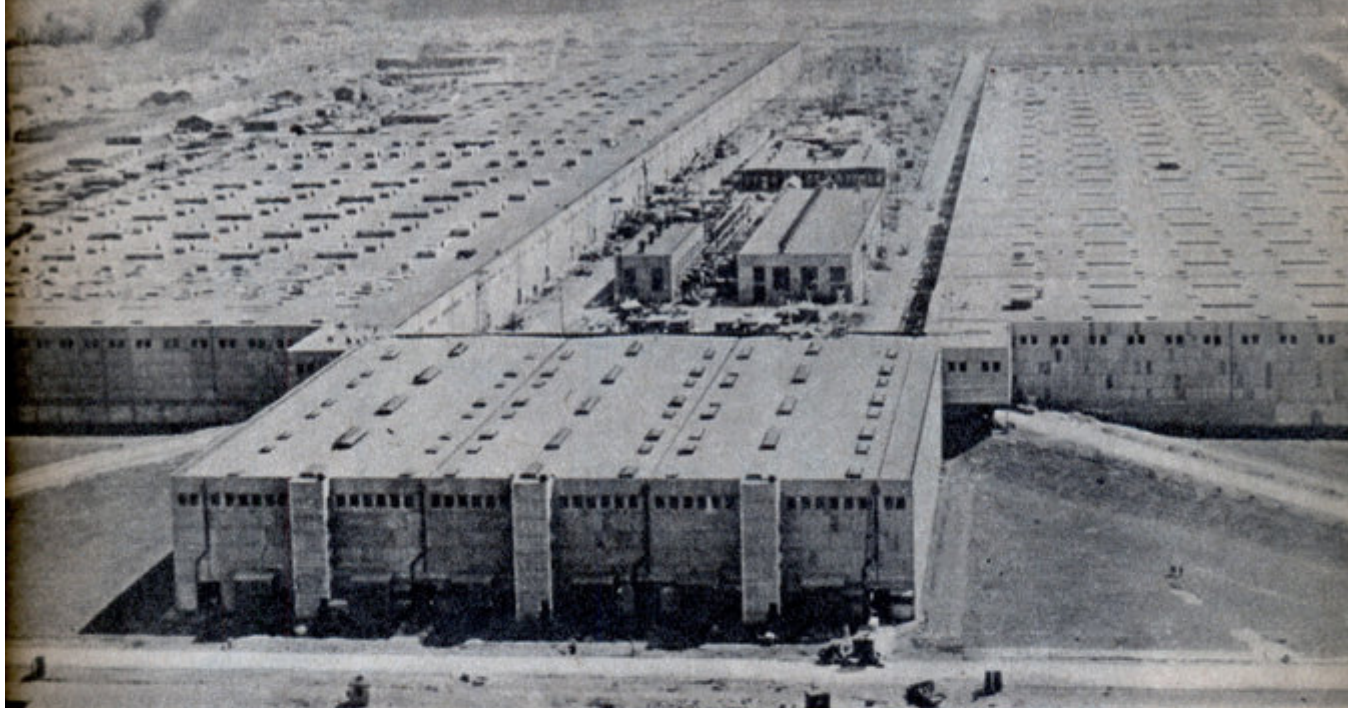
Our own experience in manu- [Continued on page 62]



SOVIET ATOM BOMB
might have been tested
somewhere in Siberia—
perhaps in the crater of
the great 1908 meteorite.
Foreign Minister Molotoff
says Russia knows the
secret of the atom bomb.



Saunders



Is Russia hiding an atom-bomb factory, such as ours at Oak Ridge, in some far corner of Siberia?

until the 1960's or 1970's, perhaps indefinitely—and that it will take Russia a decade or more to acquire a stockpile of even a score or two of bombs.

When Russia gets her first bomb, can we tell?

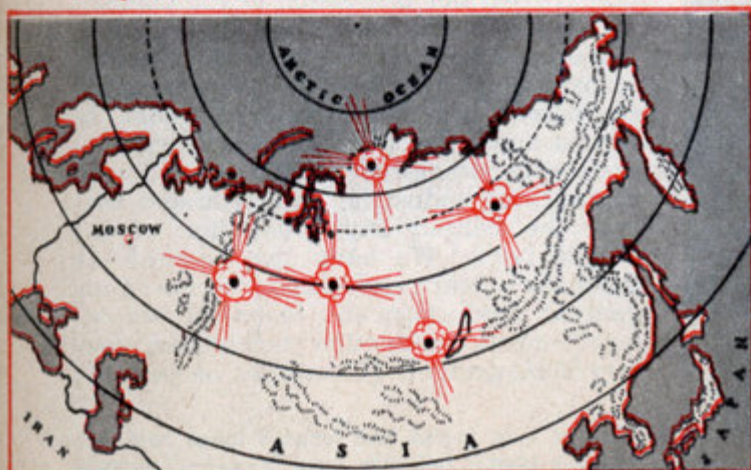
The nature of the atomic bomb is such that a nation trying to manufacture it for the first time cannot be sure of success unless a test bomb is exploded. She is likely to choose a rather remote area for this test.

She will probably choose somewhere in Siberia or in the midst of the Eurasian "heartland," or perhaps in the Arctic area far from border observation. She can almost certainly prevent visual evidence of the test leaking to the outside world.

Contrary to general impression no seismograph in the world is sensitive enough to record an atomic explosion, unless it is within 200 or 300 miles of the blast. The force of an atomic explosion is minute com-

Atom research chemist has to be careful when he lifts this bottle from its container. There's a death ray inside.

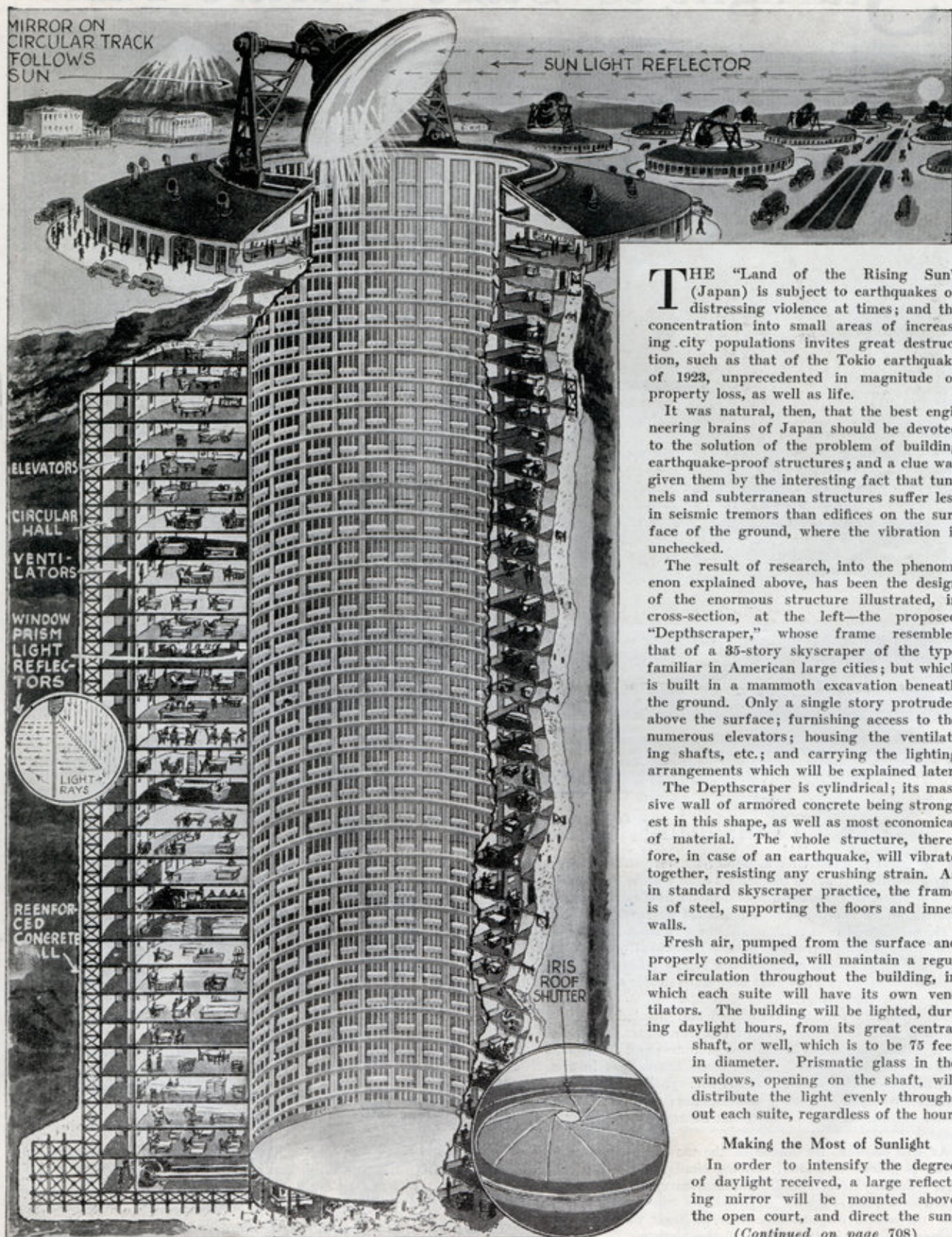
Here are five likely spots where the Russians might seek to try out an atomic bomb in secrecy—if they make one.



March, 1948



• "Depthscrapers" Defy Earthquakes •



THE "Land of the Rising Sun" (Japan) is subject to earthquakes of distressing violence at times; and the concentration into small areas of increasing city populations invites great destruction, such as that of the Tokio earthquake of 1923, unprecedented in magnitude of property loss, as well as life.

It was natural, then, that the best engineering brains of Japan should be devoted to the solution of the problem of building earthquake-proof structures; and a clue was given them by the interesting fact that tunnels and subterranean structures suffer less in seismic tremors than edifices on the surface of the ground, where the vibration is unchecked.

The result of research, into the phenomenon explained above, has been the design of the enormous structure illustrated, in cross-section, at the left—the proposed "Depthscraper," whose frame resembles that of a 35-story skyscraper of the type familiar in American large cities; but which is built in a mammoth excavation beneath the ground. Only a single story protrudes above the surface; furnishing access to the numerous elevators; housing the ventilating shafts, etc.; and carrying the lighting arrangements which will be explained later.

The Depthscraper is cylindrical; its massive wall of armored concrete being strongest in this shape, as well as most economical of material. The whole structure, therefore, in case of an earthquake, will vibrate together, resisting any crushing strain. As in standard skyscraper practice, the frame is of steel, supporting the floors and inner walls.

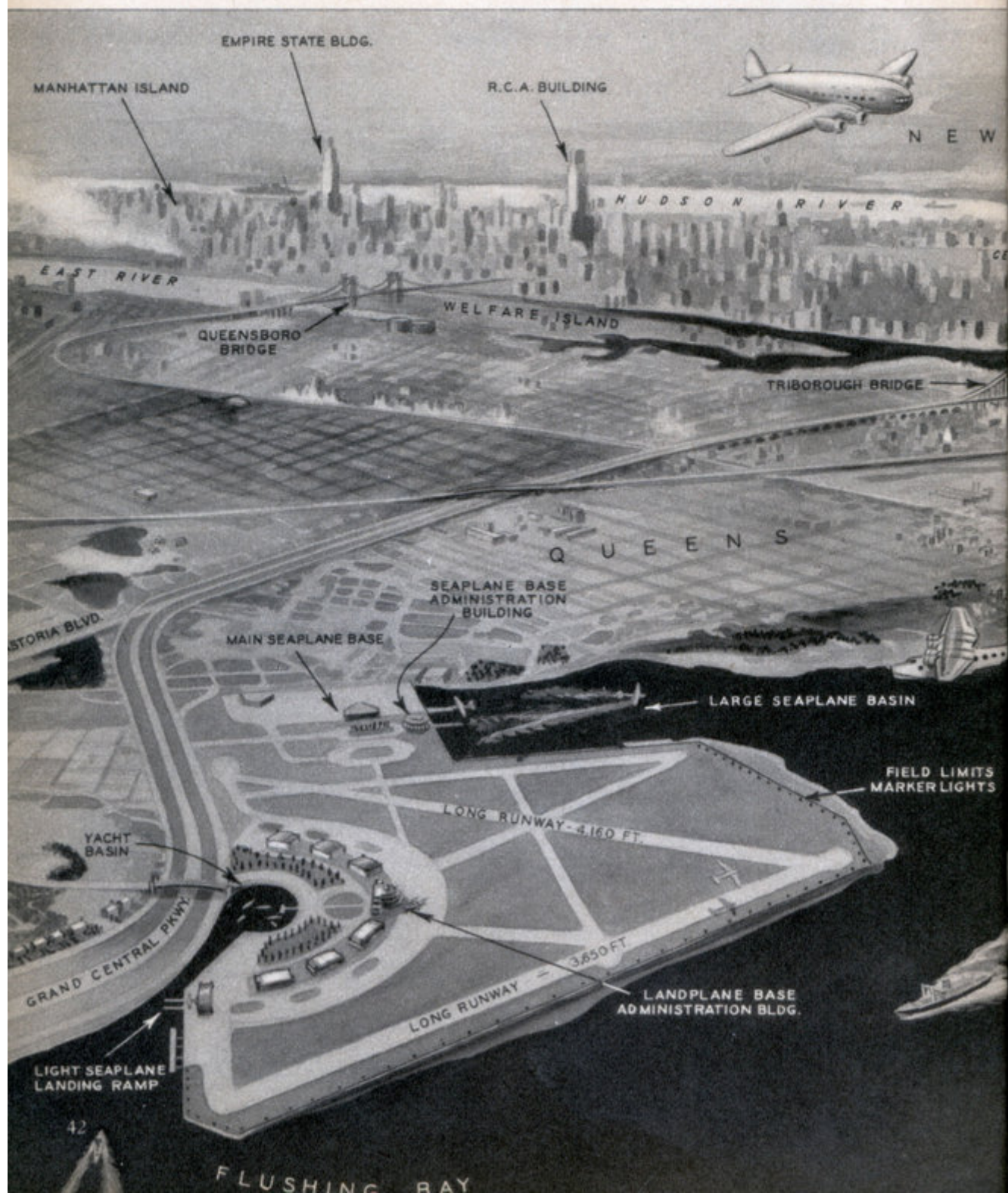
Fresh air, pumped from the surface and properly conditioned, will maintain a regular circulation throughout the building, in which each suite will have its own ventilators. The building will be lighted, during daylight hours, from its great central shaft, or well, which is to be 75 feet in diameter. Prismatic glass in the windows, opening on the shaft, will distribute the light evenly throughout each suite, regardless of the hour.

Making the Most of Sunlight

In order to intensify the degree of daylight received, a large reflecting mirror will be mounted above the open court, and direct the sun-

(Continued on page 708)

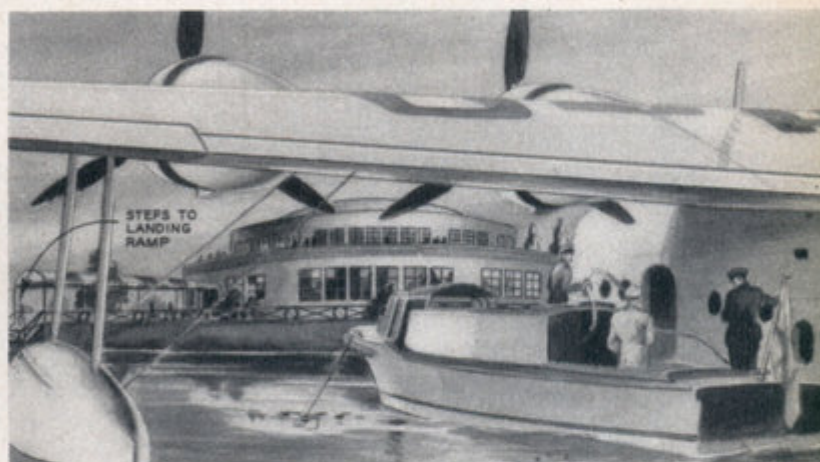
New York Builds Big for Land and Sea Plane



Airport Service



Above—Artist's sketch of the proposed North Beach Airport landplane administration building, which will be 304 feet long and 175 feet wide at center.



In the sketch above, an MI artist has depicted the seaplane base administration building as it might appear from beneath a flying clipper's wing as it rides at anchor in the landing basin. The building will be circular in shape with a diameter of 136 feet. The landplane and seaplane hangars will feature electrically-operated doors. Construction of the airport is a WPA project.

REACHED from the heart of the metropolis by a 28-minute drive over a route which crosses the famous Triborough Bridge and leads to the site of the 1939 World's Fair, North Beach Airport in the Queens section of New York, N. Y., is being enlarged in area from 105 acres to 429 acres and will be provided with every facility for the handling of giant transcontinental and transoceanic air liners. Exclusive of land, the construction cost of the enlarged airport will represent a cost of about 12 million dollars.

The completed airport, as shown in the artist's sketch at left, will feature four main runways, one of which will be 4,160 feet long, to accommodate land planes while a vast seaplane basin will provide landing and takeoff facilities for flying "clippers." Plans for the reconstruction of the airport were prepared by engineers of the Works Progress Administration in co-operation with the city's Department of Docks. The airport's hangars and administration buildings will represent the latest ideas in airport architecture.

History's Biggest Show

REVIEWS WORLD'S GREATEST CENTURY

1833...



By EDWIN TEALE

AFTER a forty-year journey through space, a reddish ray of starlight has just struck a photo-electric cell and flashed on the lights of a \$25,000,000 extravaganza of science, the Century of Progress Exposition at Chicago.

Islands to accommodate the show, were built in the waters of Lake Michigan. Grass and trees and towering buildings cover them and hundreds of thousands of glowing, gas-filled tubes illuminate the great exposition.

Covering 338 acres, the thousands of exhibits compress into the scope of an exposition the drama and wonder of history's most amazing century of scientific advance. Under your eyes, crude rubber changes into auto tires; casein, extracted from milk, becomes a fountain pen; piles of parts turn into automobiles that speed away under their own power.

You see icicles forming on a red-hot wire and listen to an eight-foot talking tooth. You watch the blood circulate through the veins of a transparent man, read the temperature from a 200-foot thermometer, and see an umbrella made of water. Artificial Northern Lights flare and flicker in rainbow hues; educational pictures appear on curtains of steam, and prehistoric monsters, mechanically reproduced, feed and fight as they did millions of years before human history dawned.

Everywhere there is action. It is the key to the whole thrilling panorama. The exhibits at the Chicago Exposition

... 1933

show processes instead of products. They demonstrate how things are made and give exciting glimpses behind the scenes of science and industry.

Abstruse scientific laws, for instance, are made plain by athletes riding on whirling disks. How twigs grow and flowers are fertilized are shown through elaborate moving mechanisms. To make possible some of these exhibits, whole new machines had to be invented.

The central building, the great nine-and-a-half-acre Hall of Science, shown at the head of this article, is like a 300-ringed circus, every room containing its fascinating bit of dramatized human knowledge. In the physics section, more than a hundred displays turn textbook principles into action, light, and color.

Here a three-foot raindrop alternately evaporates and condenses from morning until night. Two hundred white billiard balls, clustered in a depression at the center of a huge black table, represent the molecules of water in a raindrop. At the center of the depression, a square block of wood rotates at varying speeds, high speed corresponding to high temperature and low speed to low temperature. As the rate of rotation increases, the balls, struck by the projecting corners, bounce out of the depression and roll over the black table, just as molecules leave a waterdrop when it begins to evaporate.

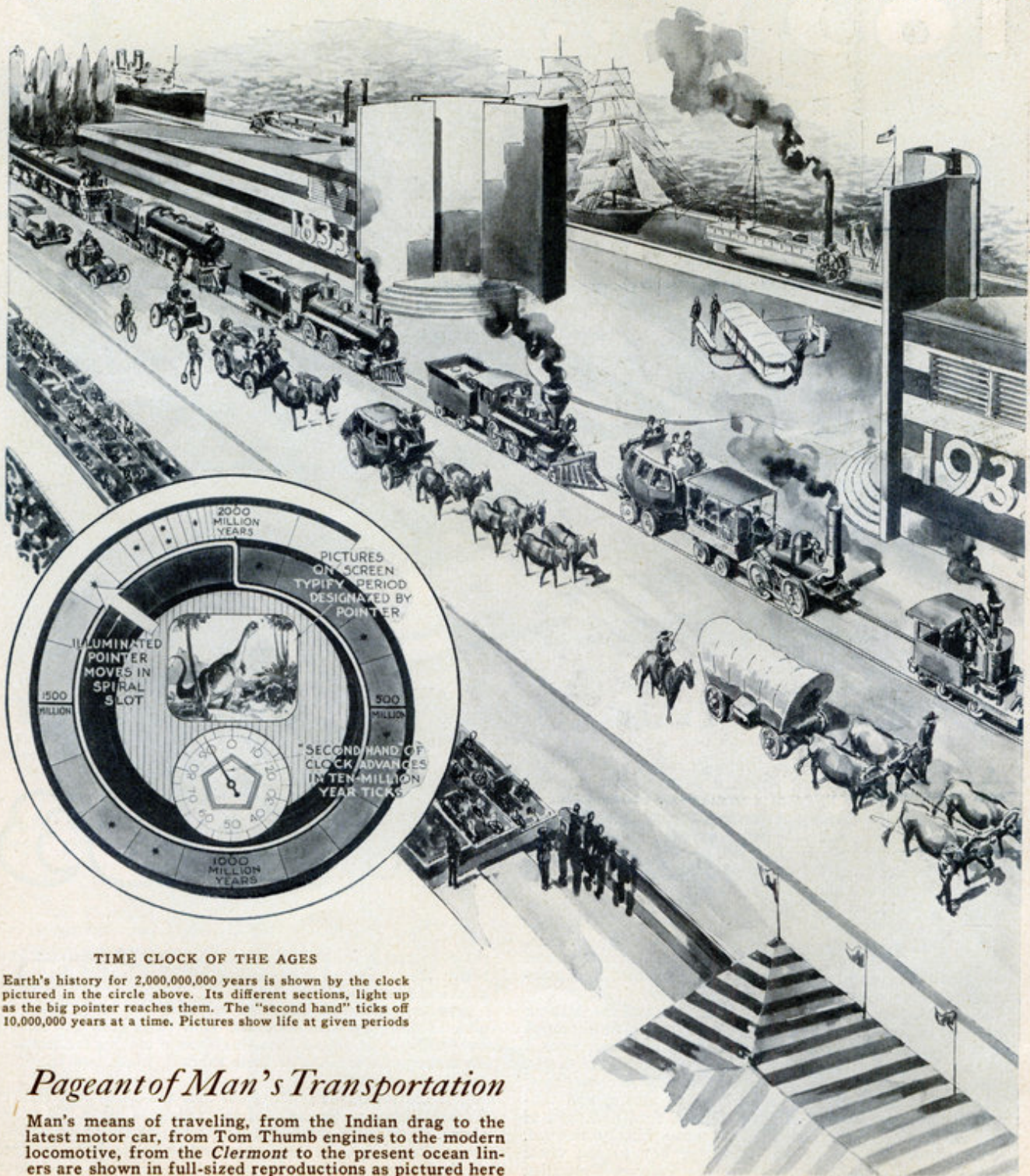
When the block is spinning at top speed, all the balls are jostling over the table and the depression is empty. The raindrop has evaporated. Then the whirling block slows down and the molecules roll back into the depression, condensing once more.

Nearby is shown a bewildering feat of scientific magic. In a glass case, an icicle is slowly forming on a red-hot wire! The explanation is that the air has been practically exhausted from the container. Consequently, when water is fed into the vacuum chamber along the wire, evaporation, and the resulting cooling, is so

rapid that the water turns to ice in spite of the heat of the wires.

Another glass chamber reproduces in miniature Piccard's flight into the stratosphere. Spectators see how the gas within a tiny balloon expands as the air is pumped out of the bell jar until the pressure corresponds to that of the rarefied atmosphere ten miles above the surface of the earth. Then they watch it contract again during the return journey to sea level.

In the main hall, below, they can examine the actual sphere of aluminum in which Piccard rode to his record height



TIME CLOCK OF THE AGES

Earth's history for 2,000,000,000 years is shown by the clock pictured in the circle above. Its different sections, light up as the big pointer reaches them. The "second hand" ticks off 10,000,000 years at a time. Pictures show life at given periods

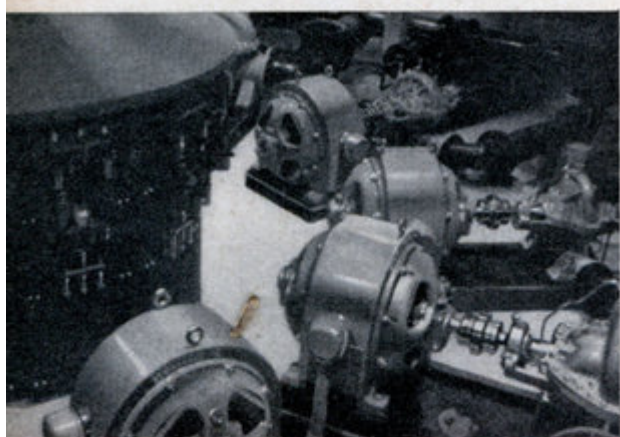
Pageant of Man's Transportation

Man's means of traveling, from the Indian drag to the latest motor car, from Tom Thumb engines to the modern locomotive, from the *Clermont* to the present ocean liners are shown in full-sized reproductions as pictured here

By
KENNETH M. SWEZEY

Fountains of

The spectacular Lagoon of Nations display at the New York World's Fair, with some of the mechanical marvels behind the scenes. Inset at left shows part of the giant pumping station that supplies water. At bottom, the control room from which the elaborate performance is stage-managed



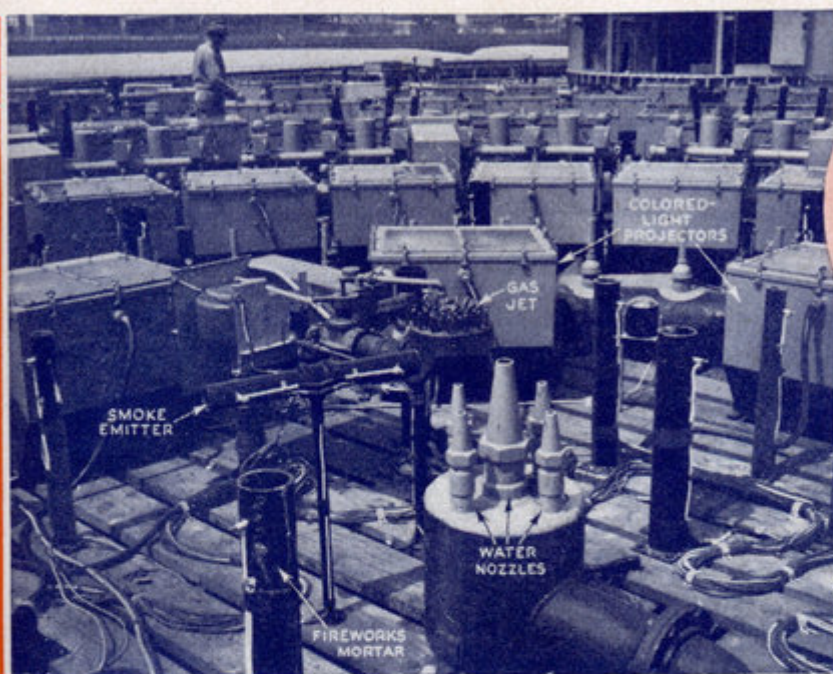
WATER, light, flame, music, and fireworks, synchronized into a vast extravaganza, are providing new entertainment thrills nightly as one of the most spectacular outdoor attractions of the New York World's Fair.

This Lagoon of Nations display centers in a giant fountain which rises from an oval lake two blocks wide by four blocks long. Water, geysering in beautiful patterns from 1,400 nozzles, is painted in constantly changing rainbow hues by batteries of powerful electric lights from below. At climaxes in a performance, towering gas flames roar through the columns of scintillating water, from more than a hundred jets. Showers of



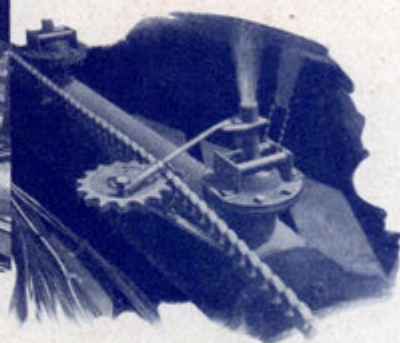
Flame

PLAYED LIKE A PIPE ORGAN



INSIDE A MAN- MADE GEYSER

This maze of lights, pipes, and nozzles is the inside of one of the three fountains in the lagoon. Below, how outer nozzles are tilted in a twenty-degree arc



fireworks burst overhead. Stirring music thunders an accompaniment to the display from the heart of the fountain.

The whole complex mechanism is "played," as if it were some mighty organ, by three operators at electric consoles located in a near-by tower. Regular programs, based on such themes as "The Spirit of George Washington," "Creation," "Isle of Dreams," "Fire Dance," are presented to tens of thousands of spectators each evening.

Every performance is as carefully designed, staged, and rehearsed as a Broadway show or a grand-opera production. After a theme is selected, Jean Labatut, professor of architecture at Princeton University, makes sketches indicating the desired shape and color of the fountain and noting fireworks creations where needed to express the changing moods of the theme. These sketches are given to Russell Bennett, composer, who

writes and arranges music to harmonize with them.

Next, John Craig, expert pyrotechnician, is called in to create fireworks to meet Professor Labatut's exacting demands. Not only must these explode with the colors and patterns desired, but they must be almost noiseless, so that the music may be heard above them. Their charges must also be precisely calculated so that no dangerous sparks will overshoot the lagoon.

Designing work finished, technicians translate the drawings into elaborate combinations of settings of switches, buttons, and dials. These, through valves, electric impulses, and sparks, control the fountain jets, regulate the color of the lighting, ignite gas flames and fireworks. So that sequences during a performance may be exactly timed, the settings are marked by means of symbols on long paper cue sheets which unwind

**Behind the Scenes
of a Vast Display
in Which Water,
Flame, Fireworks,
Color, and Music
Are Blended
Like Magic**



slowly, on rolls driven by synchronous motors, before the various operators.

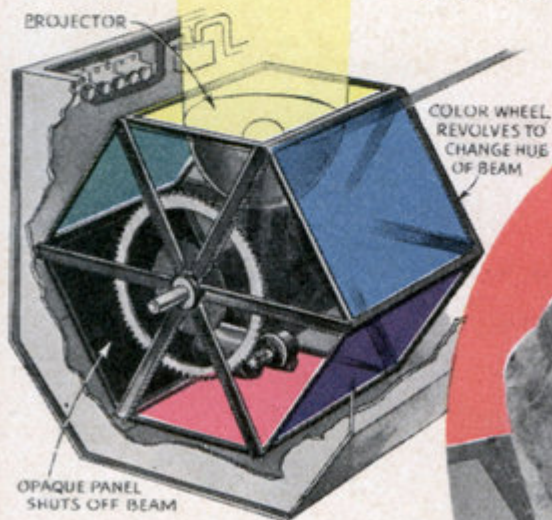
Created under the direction of Bassett Jones, electrical and lighting engineer, this powerful new instrument of entertainment cost \$650,000, and required more than a year and a half for experimental work and construction. Hydraulic engineers, gas-company chemists, fireworks manufacturers, illumination authorities, display designers, architects, color experts, and artists have all collaborated.

A quick survey of the mechanism reveals some almost incredible figures. Mounted on a 500-foot timber platform, on the bottom of the lagoon, sixteen carloads of piping and two carloads of hydraulic valves deliver water to 653 vertical nozzles, arranged in geometric patterns, and to 812 atomizing nozzles which outline the entire fountain. A 2,700-horsepower battery of electrically driven centrifugal pumps, in a circular glass-enclosed pump-room near-by, supplies these nozzles with 280 tons of water a minute.

When a script calls for it, water from a central nozzle may be spouted skyward 180 feet—as high as a fifteen-story building. Two other jets reach 150 feet, while the largest circle of nozzles, which forms among other figures a sheaf of golden wheat ninety feet in diameter and ninety feet high, can hurl its cylinder of water into the air with the force of sixty-two modern fire-fighting engines!

Lighting the water with more than 2,000,000 candle power of beautiful pastel colors is accomplished by a battery of 585 huge light-

DRAWINGS BY
B. G. SEIELSTAD



AN ARTIFICIAL RAINBOW

Color wheels like this, driven by synchronous motors, turn the spray into a kaleidoscope of pastel hues. At the right, workmen are adjusting two of the 585 big projectors





A SCENE TO THRILL THOUSANDS

At a climax in one of the fountain spectacles, water, flame, fireworks, and music are blended together with overpowering effect

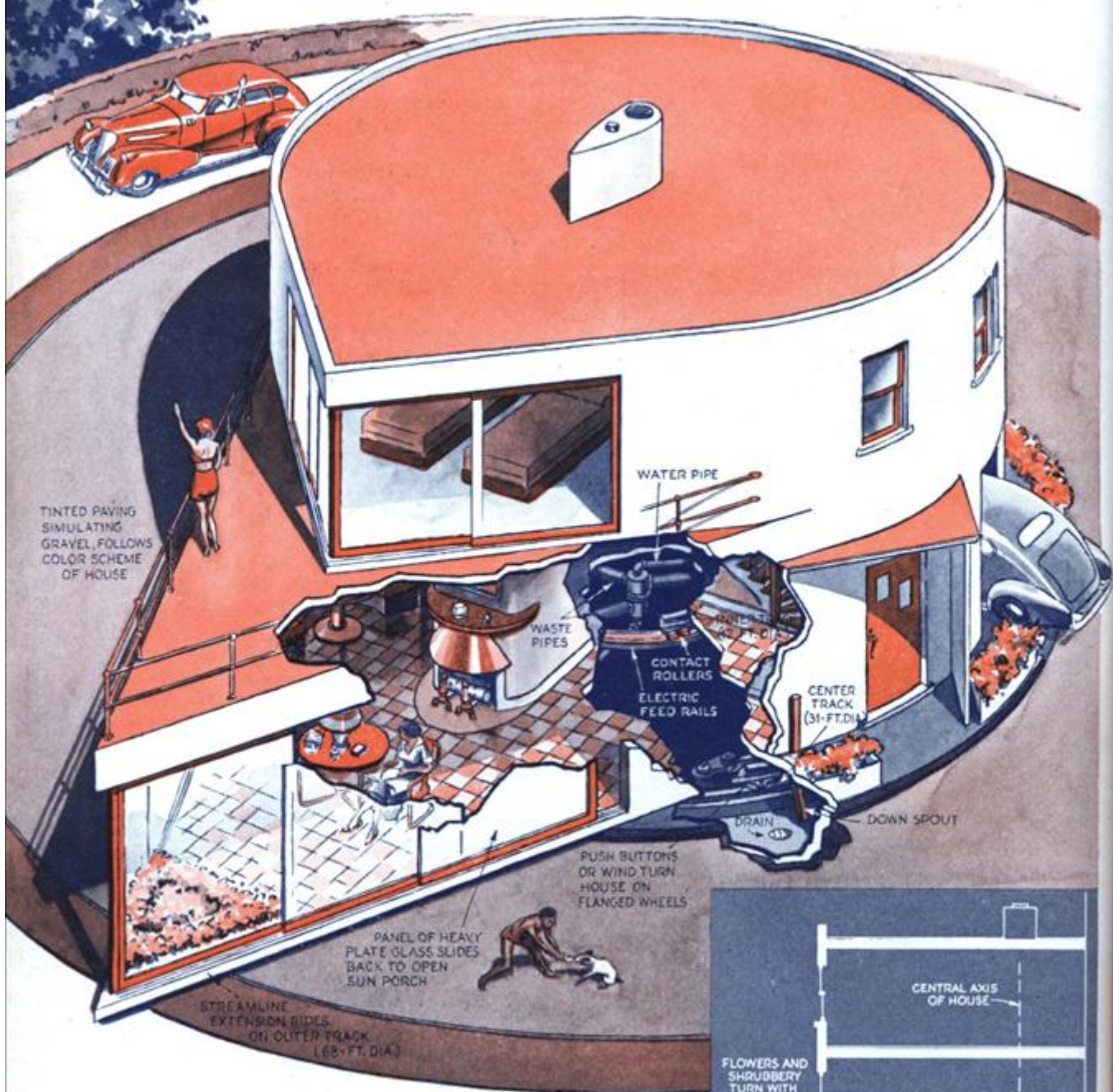
ing drums, almost completely submerged, and by hidden searchlights that illuminate the tops of the highest jets. Each drum contains two projector units, one powered by a special 400-watt mercury arc lamp and the other by a 1,500-watt tungsten lamp. About each projector unit revolves a hexagonal color wheel, driven remotely by a synchronous motor that turns the wheel at one revolution a minute. By combining, for the first time, the spectra of the two types of light—the mercury arc extending deep into the blue-violet, and the tungsten into the red—gorgeous new pinks, blues, and crystal whites are obtained, surpassing any previously possible.

Three hundred fireworks mortars and smoke machines, touched off by electric sparks, and 135 huge gas jets capable of spurting chemically colored flames thirty feet high through the cascades of water, bristle among nozzles and lighting drums. So great is the consumption of gas by these latter jets, that two gas companies unite their facilities to supply the amount needed during a half-hour performance!

To obtain greatest realism in the audible part of the display, "canned" sound has been banned from the feature displays except for special effects. In a building several blocks from the fountain, a forty-two-piece band, an electric organ, or a fine carillon plays into two microphones separated, so as to pick up the tones from two different points. The music is timed by means of a fourth cue sheet, synchronized with the three in the control room.

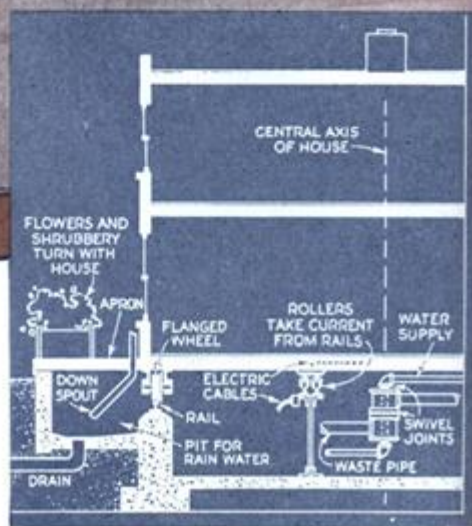
Hurricane House

WEATHER-VANE DWELLING DESIGNED FOR



Rotating on triple circular tracks, this unusual house turns itself to point its rounded end into the wind, defying even gales of hurricane force. In ordinary weather, it can be made to face in the best direction with reference to sun and breeze

By CARL WARDEN



Turns with Wind

BOTH SAFETY AND COMFORT

WHEN raging storms whip across the land, accompanied by violent gales that uproot trees, tear the roofs from houses, and turn a trim countryside into a scene of desolation, there could probably be no safer refuge than the interior of a novel hurricane house designed by Edwin A. Koch, New York City architect. Streamline in the form of a mammoth tear-drop, this amazing dwelling would revolve automatically to face into the oncoming storm, meeting it like the wing of an airplane and passing it smoothly around its curving sides toward its pointed tip.

Although planned for areas subject to periodic winds of gale force, the unique home has other unusual features that adapt it to luxurious living in any climate. Constructed of light steel channels and I-beam sections

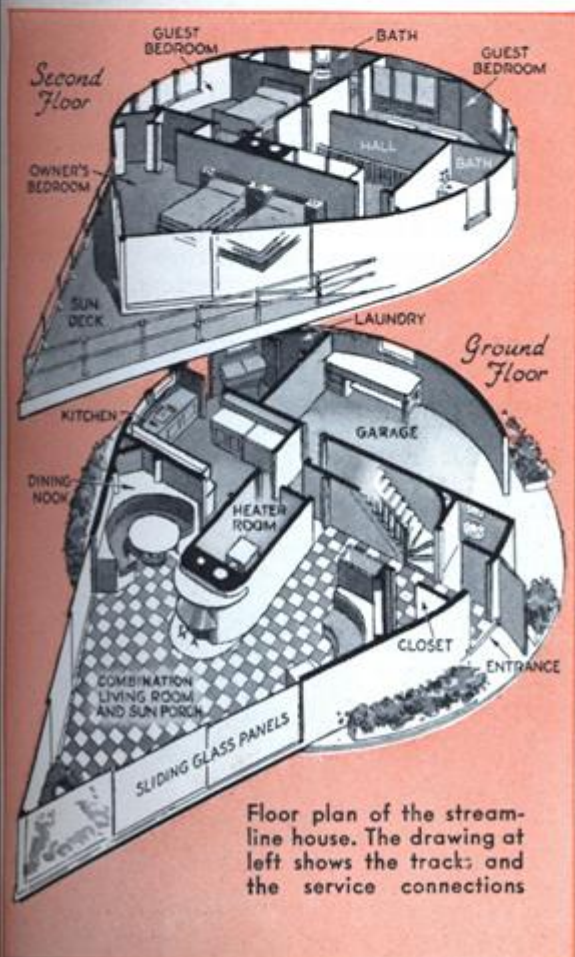


bolted together, the house has insulated walls faced on the exterior with semiflexible waterproof plywood. The entire structure rests on flanged wheels similar in construction to those found on a highway or railroad drawbridge. These run on three separate circular tracks: an inner track twelve feet in diameter, a second, placed just below the exterior walls, measuring thirty-one feet in diameter, and an outside, sixty-eight foot track for a wheel located at the pointed tip of the dwelling and cleverly concealed by an indoor living-room flower-bed.

A cantilevered floor covered with boiler plate extends beyond the outside walls for a distance of four feet to prevent driving rains from beating into the pit below the house, and to form an apron for the garage, a platform for the entrance doorways, and a ledge for flower boxes. Electricity enters the building through the inner track, while the water-supply and sewage pipes come in underground at the axis on which the house turns, swivel joints being provided to connect the stationary exterior pipes with those which are attached to the dwelling.

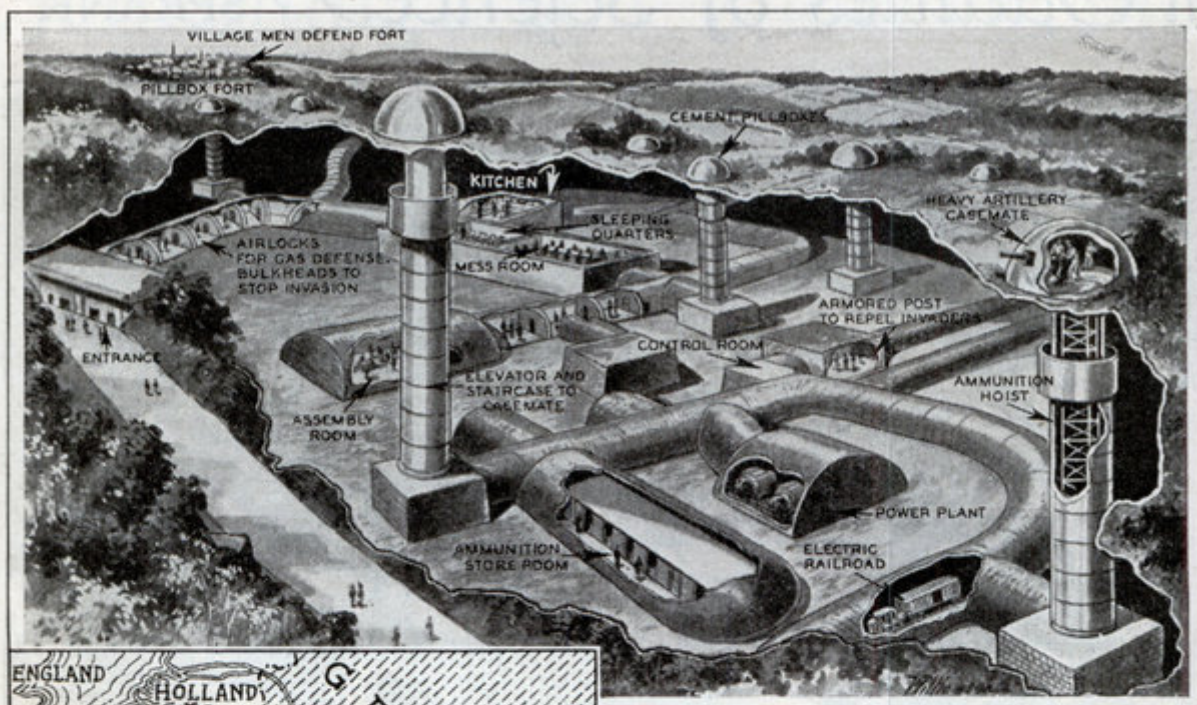
Inside the house, the first floor provides an entrance hall, a triangular living room with a built-in dining section on one side and a built-in library nook on the other, a kitchen, laundry, heater room, and a garage having space for a workbench and a trapdoor that provides access to the piping, wiring, and track mechanisms in the foundation pit below. Upstairs there are three large bedrooms, two baths, and a spacious open sun deck. Garage doors, and most of the broad expanse of glass windows, slide into the walls.

Merely by selecting the desired push button on a central control board, the entire house may be rotated to face rooms toward or away from the sun or to point bedroom windows toward a cooling breeze.



Floor plan of the streamline house. The drawing at left shows the tracks and the service connections

World's Greatest Underground Fortifications Guard France



Solid black line shows location of 200 mile system of French underground forts, opposite disputed Saar basin.

German Rises Six Miles in Rocket

IN HISTORY'S first successful rocket flight, Otto Fischer, brother of the inventor of the rocket plane, was shot 32,000 feet into the air in a shining 24-foot steel projectile.

With a blinding flash the rocket ship shot out of its steel framework and disappeared into the sky. It reappeared a few minutes later, dangling from a parachute, its pilot maneuvering to land on the little island of Rugen in the Baltic Sea, where the flight started.

The pilot was quoted as saying, "I left the ground in a deafening roar and lost consciousness for a moment. When I came to my senses the altimeter was flickering at 32,000 feet. It began to drop rapidly. I pulled the parachute release ring."

Buried deep beneath hills are the impregnable forts shown in the above drawing. Even railways are provided for.

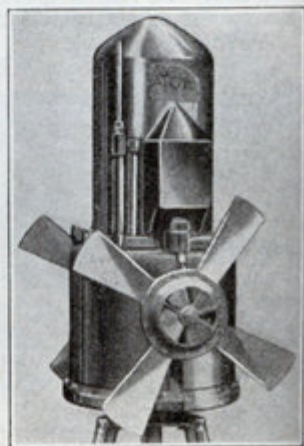
INVISIBLE and sunk beneath the rolling land and wooded terrain in Lorraine is a great underground fortification system, 200 miles long, guarding France's vital industrial area.

The forts, which cost 150 million dollars, are the greatest in the world and defy attack by gas, infantry, artillery, or air bombs. Living quarters, magazines, power stations, and control stations are out of reach of all means of attack. Bulkheads in the underground passages shut out both gas and invaders and armored posts at various points bring additional protection.

Moisture Fan Bests Tropic Heat

NEW air conditioning fans, tiny but wonderfully efficient, are being installed in every French government office in the tropics.

A drum filled with ice water or other liquid revolves inside the unit, throwing liquid out through short capillary tubes into blades of two fans turning at 4000 r.p.m. Large halls can be cooled and humidified in 10 min.



In this French air conditioning unit, the fan blades, driven at a speed of 4000 r.p.m., cool rooms with washed air.

Rail FLYER to Set New SPEED Marks

THE rail flyer, the inventor has called this new space-consuming creation of engineering, and it has several very good reasons for its existence.

It is so constructed that it is able to overcome one of the great problems of rapid transportation; the problem of traction. Every vehicle has tractive power, the ability to move forward under applied force.

When these great pieces of buzzing, roaring mechanisms like those used by Capt. Campbell at Daytona Beach, reach their maximum speeds of over two hundred miles per hour they are getting close to the limit of traction; that is the limit where, due to the great force applied to the wheels, the wheels will do nothing but slip helplessly around. As a matter of fact, in these super-machines, a great deal of the energy fed to the wheels is dissipated in this manner.

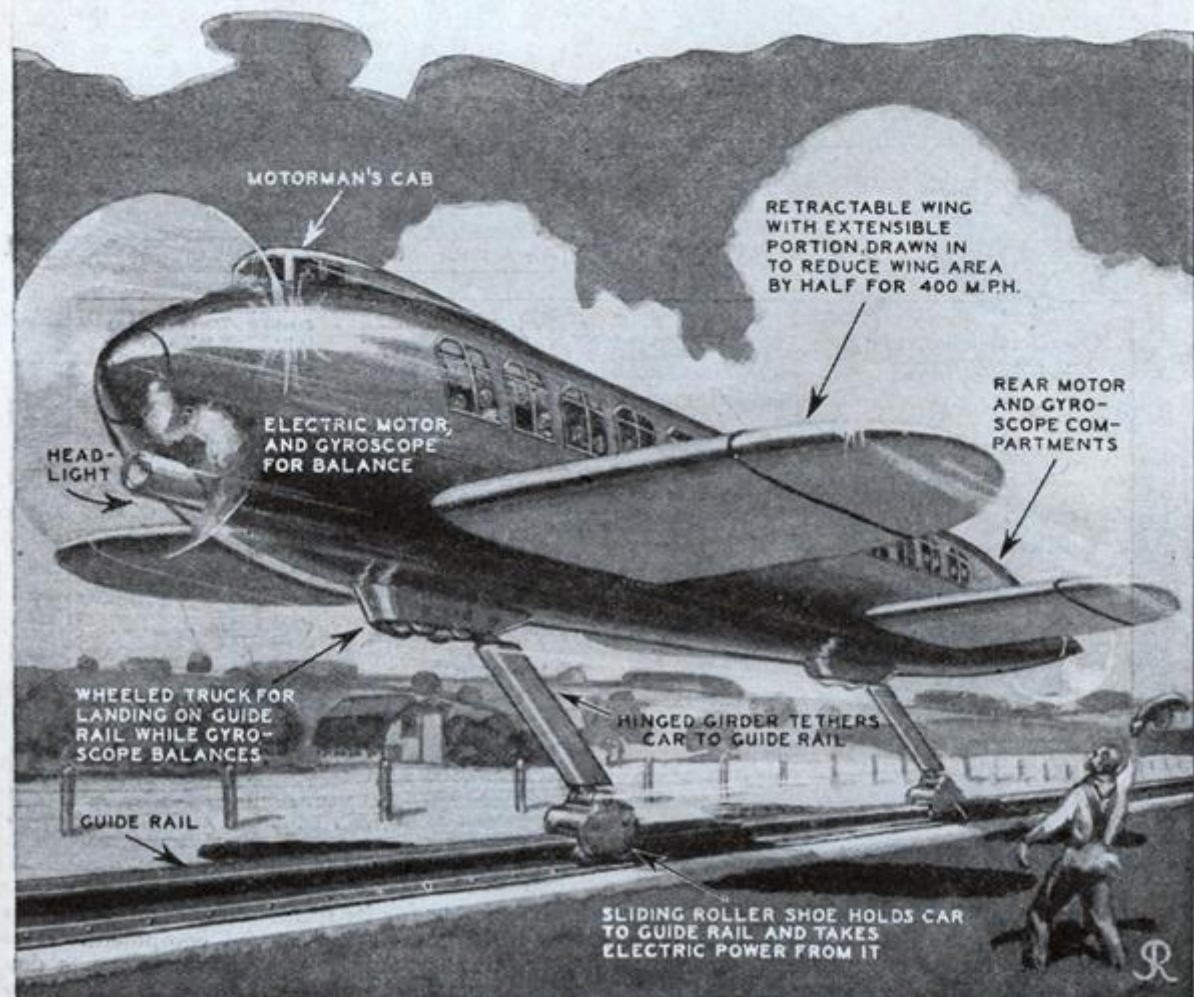
Anybody who has had the opportunity of holding the hand on the tire of a racing car after it has been driven at the rate of a hundred miles per hour for several hours will be very forcibly reminded of this loss of tractive power through excessive speed.

The tires will be so hot that they will almost burn the hand.

With the still greater demands for speed and more speed, the engineers are beginning to ask themselves when, due to the problem outlined above, we shall have reached the limit.

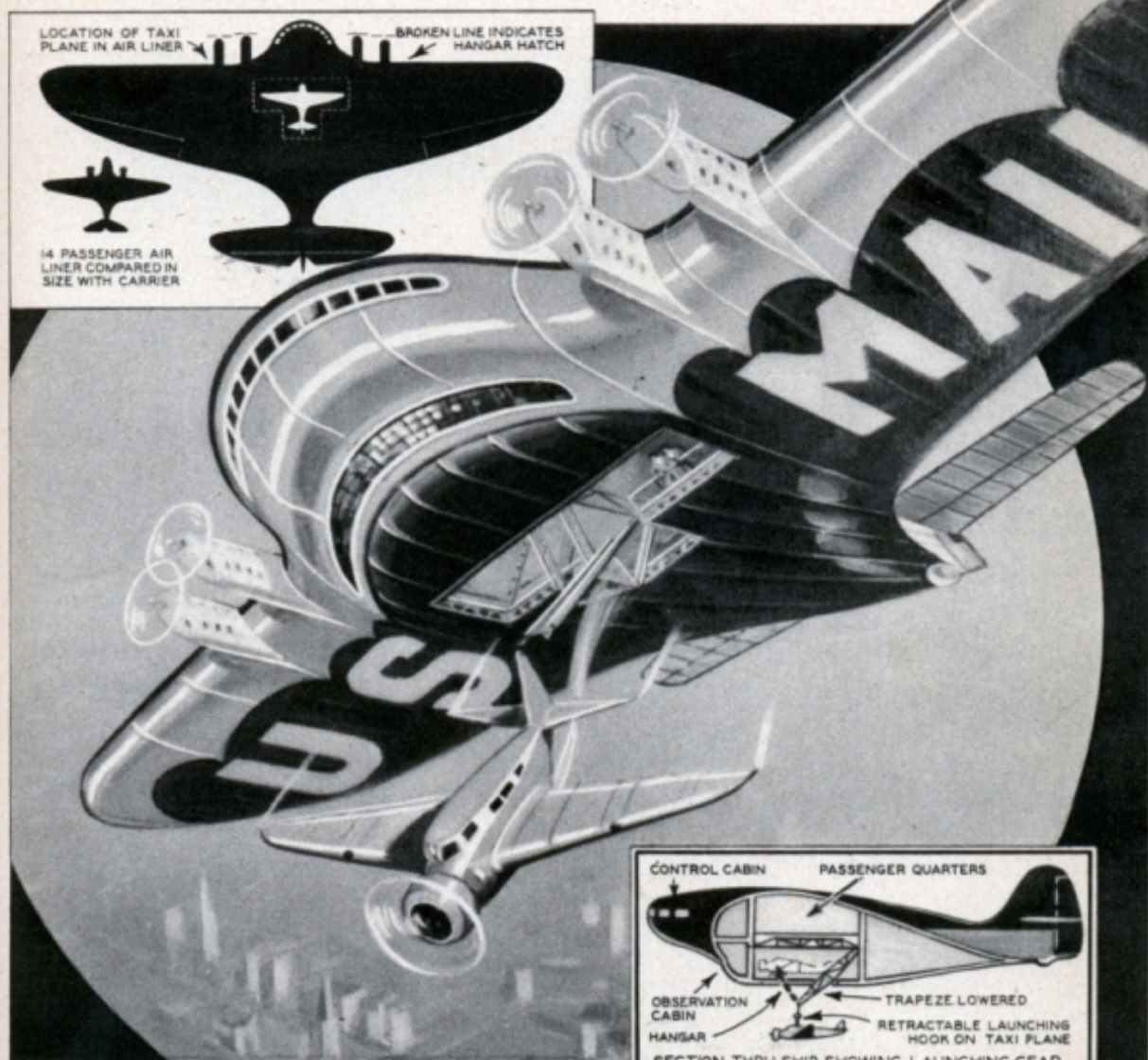
But why not take to the air with planes that will not have to depend upon weather conditions; planes that will move through fogs, snow and wind as easily as do our largest and most powerful locomotives. Not only will they do this but they will also reach prodigious speeds of over five hundred miles per hour by practically eliminating all friction with solid materials.

The rail flyer will do these things. It really amounts to a captive airplane, which, when its power is turned off, will descend gently to its guiding rail, its gyroscope holding it perfectly vertical even in the face of driving winds. Surely this would provide new luxury of travel with one hour between New York and Buffalo and a little more than two hours between New York and Chicago.



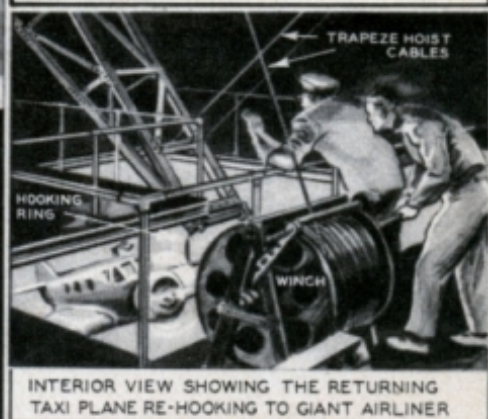
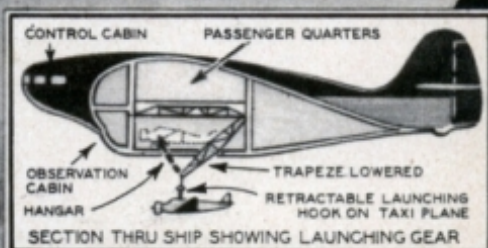
Flying by rail. It is expected that this method of travel will overcome traction difficulties encountered at extreme speeds.

TAXI PLANE Picks Up FREIGHT And Passengers for AIRLINER

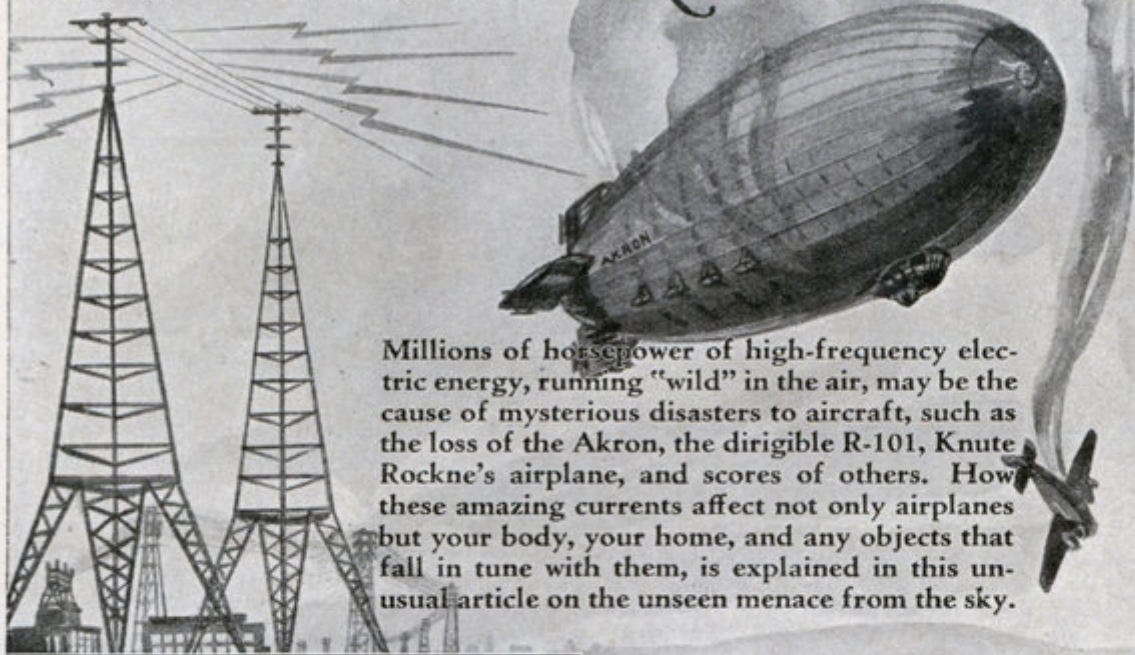


HIGH speed taxi planes that can come and go from a giant "mother" air transport at will are proposed as a means of providing fast, non-stop transcontinental air service. The smaller ship, released over a city, would land at the airport to discharge and take on passengers and freight, then soar upwards again to catch up with the slower airliner.

As may be seen from the sketches, the method of launching the taxi plane is very similar to that used by the U. S. Navy in handling pursuit planes on dirigibles. A trapeze crane lifts the small ship into the hull of the transport, where passengers may be transferred to roomy quarters on the airliner.



Do WILD Radio Waves



Millions of horsepower of high-frequency electric energy, running "wild" in the air, may be the cause of mysterious disasters to aircraft, such as the loss of the Akron, the dirigible R-101, Knute Rockne's airplane, and scores of others. How these amazing currents affect not only airplanes but your body, your home, and any objects that fall in tune with them, is explained in this unusual article on the unseen menace from the sky.

by BURTON MANFRED

THE radio experts of the United States Navy have recently completed a series of astounding experiments, experiments that prove far beyond the shadow of human error that there is a new menace in the sky. Hour after hour, day after day countless thousands of horsepower of high-frequency electric energy is being pumped into the air by great radio stations and other high-frequency machinery which has become a part of our civilization.

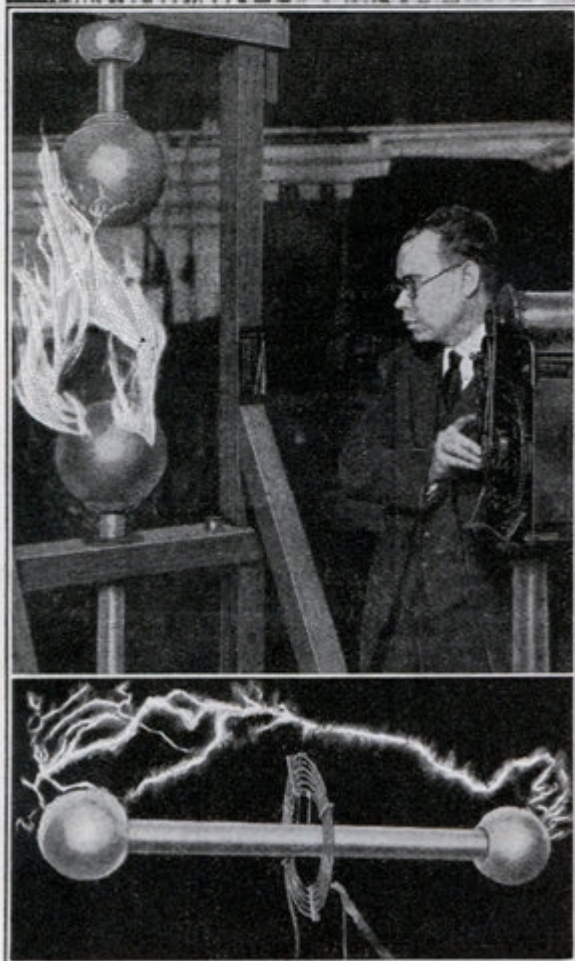
Only an infinitesimal speck of this prodigious output of energy is consumed by the radio receivers of the world. What happens to the rest? Does it become a wild and roving source of death and destruction or does it rush into the frigid voids of space never to return to the earth?

What Happens to Wild Energy?

Engineers have found that it does both, great quantities of it being absorbed by living and inanimate objects and in these objects it is detectable as surging forces of electric current. Even the man-in-the-street absorbs a part of this energy and the tissues of his body are seats of tiny electric currents in tune with the powerful broadcast transmitters of the land.

It is only when these wild waves reach large metal structures, however, that danger develops. In such structures electric currents often reaching a potential of several thousands of volts are generated and sparks or discharges may be produced that will cause fire or explosion.

These new discoveries of radio engineers naturally bring up the subject of the mysterious airplane and sea accidents that have



Destructiveness of high potential currents is demonstrated in these Tesla coils. Tremendous voltages are built up by induced current until they break loose and jump the gap.

Cause AIR DISASTERS?



...and ... were from the Continent; a girl of sixteen ...
 As we write, accounts of the disaster are necessarily somewhat
 confused, and considerable investigation will have to be made before a decision
 is to the cause of it can be arrived at. It would appear that the air-liner took
 fire while in the air, and eye-witnesses have stated that it continued its flight for
 over a mile before it crashed. The "City of Liverpool" was of the Argosy class
 twenty-two-seater three-engine biplane, with a ...

Recent example of an airplane crash whose cause remains an official mystery, as indicated by newspaper account, is that of the "City of Liverpool," crack multi-engined plane on London-Continental service. Note that it "apparently took fire in the air"—a circumstance which may well have been caused by wild radio waves through high-frequency induction. In the column at right, the phantom view of a Tesla coil, superimposed over the dirigible, indicates how high potentials can be built up in metal framework of such ships as the Akron until a point of destruction is reached.

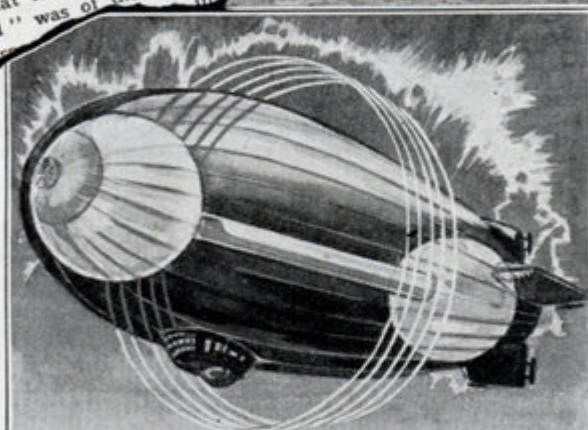
gone unsolved during the past few years. What of the Naval collier *Cyclops* that was swallowed up by the sea? Was it a victim of its own radio transmitter and did these powerful fugitive currents cause an explosion on board that obliterated it from the face of the world?

Mysterious Airplane Accidents

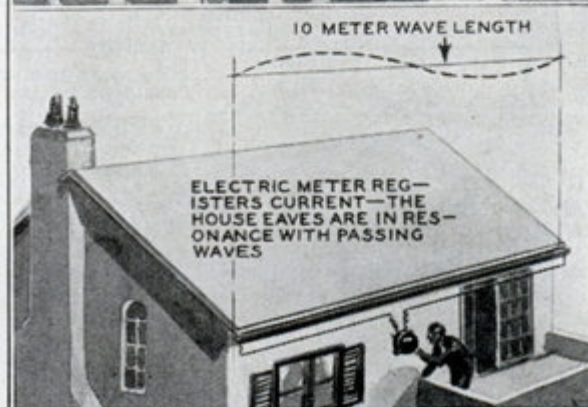
We have the same right to put the same question in connection with a number of very mysterious airplane accidents that have occurred during the past few years, notably the one in which the famous and lamented coach, Knute Rockne, was killed. The airplane is particularly susceptible because of the inevitable gasoline tank. Sparks by induced current at this point will be bound to produce fatal results if the ship is afloat.

It has long since been known also that large steel buildings in the vicinity of broadcasting stations suck in tremendous quantities of this energy and that they become veritable electric dynamos. So potent does this radiation become that small electric lights may be lit by wireless under the antennae systems of large radio stations.

Most recent of those which come to mind is the disaster of the dirigible *Akron*, the precise cause of whose collapse into the At-



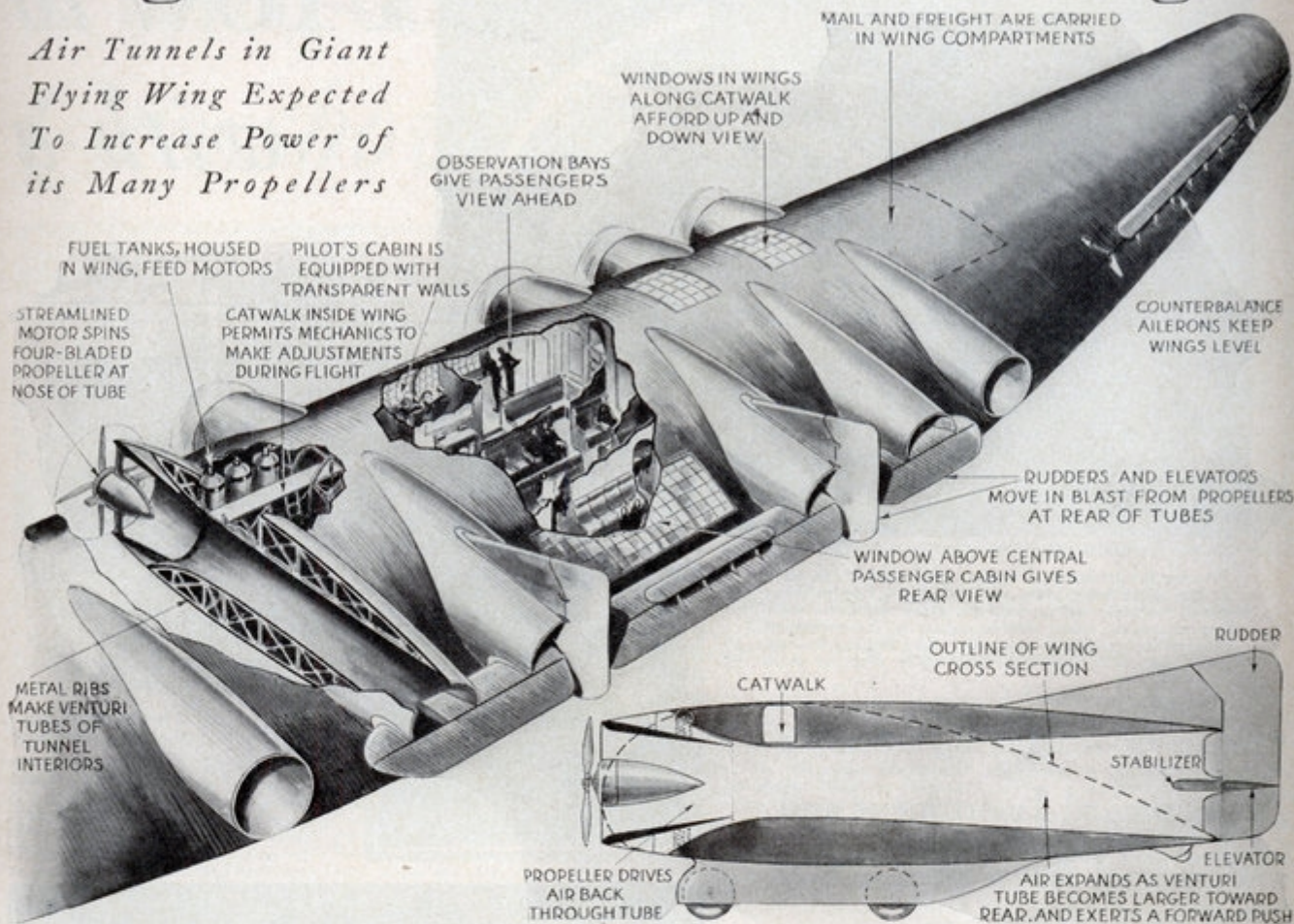
DIAGRAMMATIC VIEW SHOWING HOW "WILD" HIGH-FREQUENCY CURRENTS MAY HAVE CAUSED MYSTERY AIR DISASTERS—SUCH AS DESTRUCTION OF AKRON, R-101, KNUTE ROCKNE PLANE, AND OTHERS.



Copper house eaves, in resonance with passing waves, can set up sparks that will set the building afire. Short radio wavelengths are "in tune" with many common objects.

Huge Barrel Plane for Ocean Flights

Air Tunnels in Giant Flying Wing Expected To Increase Power of its Many Propellers



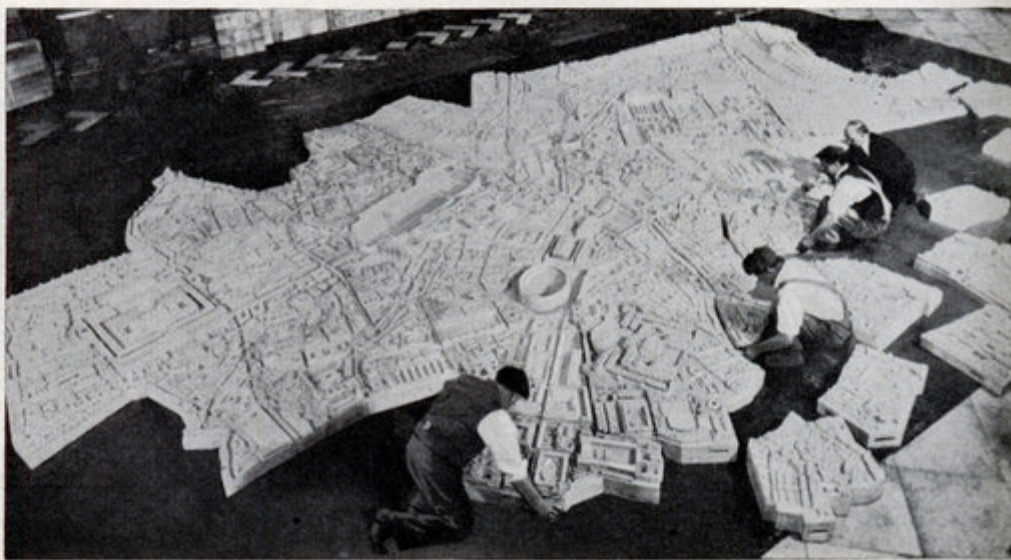
PIERCED by a battery of tunnels a flying wing airplane is proposed by an engineer at the famous Caproni airplane works in Italy. Streamlined motors and four-bladed propellers will drive air blasts through the tunnels, each of which forms a Venturi tube, expanding toward the rear. Thus, according to the inventor, the air will give a forward push something in the manner of rocket propulsion. Aided by the Italian government, the de-

signer recently completed a single-engined experimental craft incorporating his ideas. This odd flying barrel was put through successful tests near Rome. (P.S.M., Jan. '33, p. 18.) Details of the huge machine he proposes to build for transatlantic travel are shown in the pictures above. A half-dozen tunnels or more will run through the immense flying wing. Rudders and elevators will be mounted so they will move in the blasts issuing from

the tubes. The craft will be piloted from a cabin with transparent walls at the center of the leading edge of the wing. On either side will be observation bays from which passengers can look ahead. Other windows will afford a rear view from the central passenger's cabin. Another feature of the machine will be a catwalk running lengthwise through the wing. It will enable mechanics to make adjustments while the plane is in flight.

MODEL OF ROME IN 100 PARTS

LIKE fitting together a monster jigsaw puzzle is the task of assembling the sections of an immense model of ancient Rome, which has just been presented to the Pennsylvania Museum of Art at Philadelphia. It is composed of about 100 sections, and covers an area thirty-feet long and twenty-one feet wide. It was executed by Paul Bigot, noted architect and archaeologist. The illustration at right shows the model taking shape in the museum where it will illustrate the architecture of the old city.



INSIDE the Flying Wing

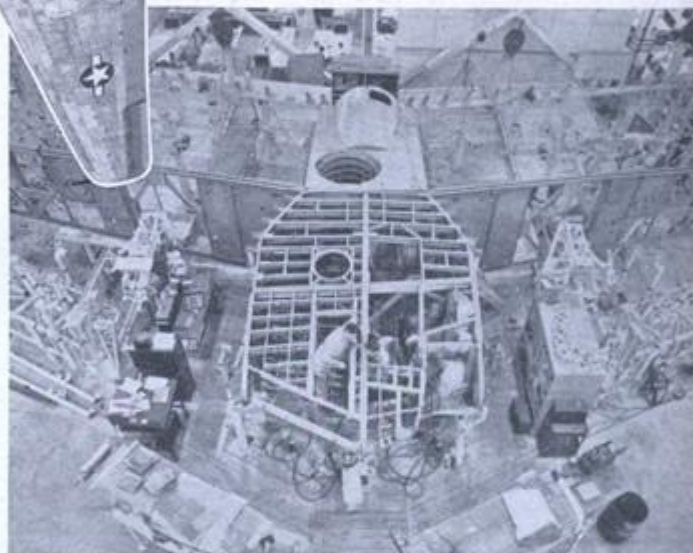


Skeleton of crew nacelle, below, shows its position, forward of the big main spar around which the trusswork is built. The cylindrical section behind the nacelle carries the tail cone, which is also accessible to the crew.

COMpletely enclosed within the outer skin of the XB-35 there is a many-sided room that houses the 15-man crew. Pressurized for high altitudes and large enough to provide sleeping accommodations for six, it is the heart of the Flying Wing.

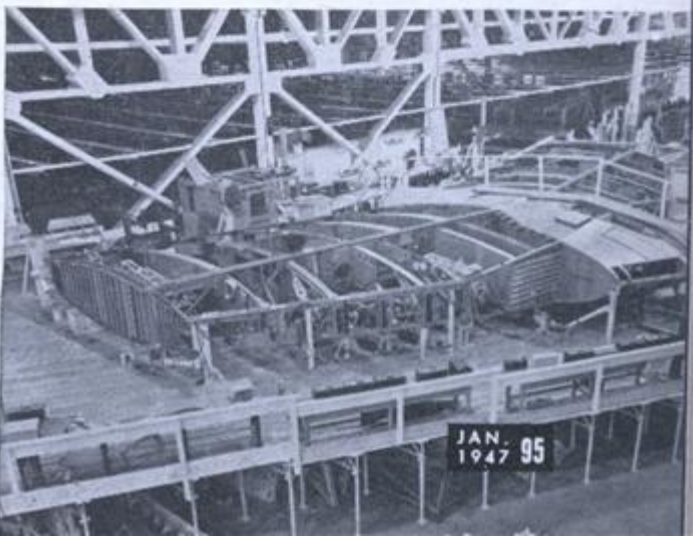
Around this center of operations is a mass of trusswork resembling a bridge—a simpler structure than that of a conventional airplane because the craft's weight is distributed throughout the wing and needs no "beefing up" around a fuselage.

The pictures on this and the following page, taken at the Northrop Aircraft plant in California, show details of the crew nacelle and the massive 172-foot framework in which it nestles.



Instruments and controls of the plane are shown in a full-size wooden mockup. Pilot's wheel is at left, and his head projects up into Plexiglas blister directly above it. Co-pilot's wheel, at lower right, is behind windows in leading edge of wing.

Structural strength of the giant wing is indicated by framework, below, taking shape around the center nacelle. This stage of construction also illustrates relative simplicity of building a plane in which the fuselage is an integral part of the wing.

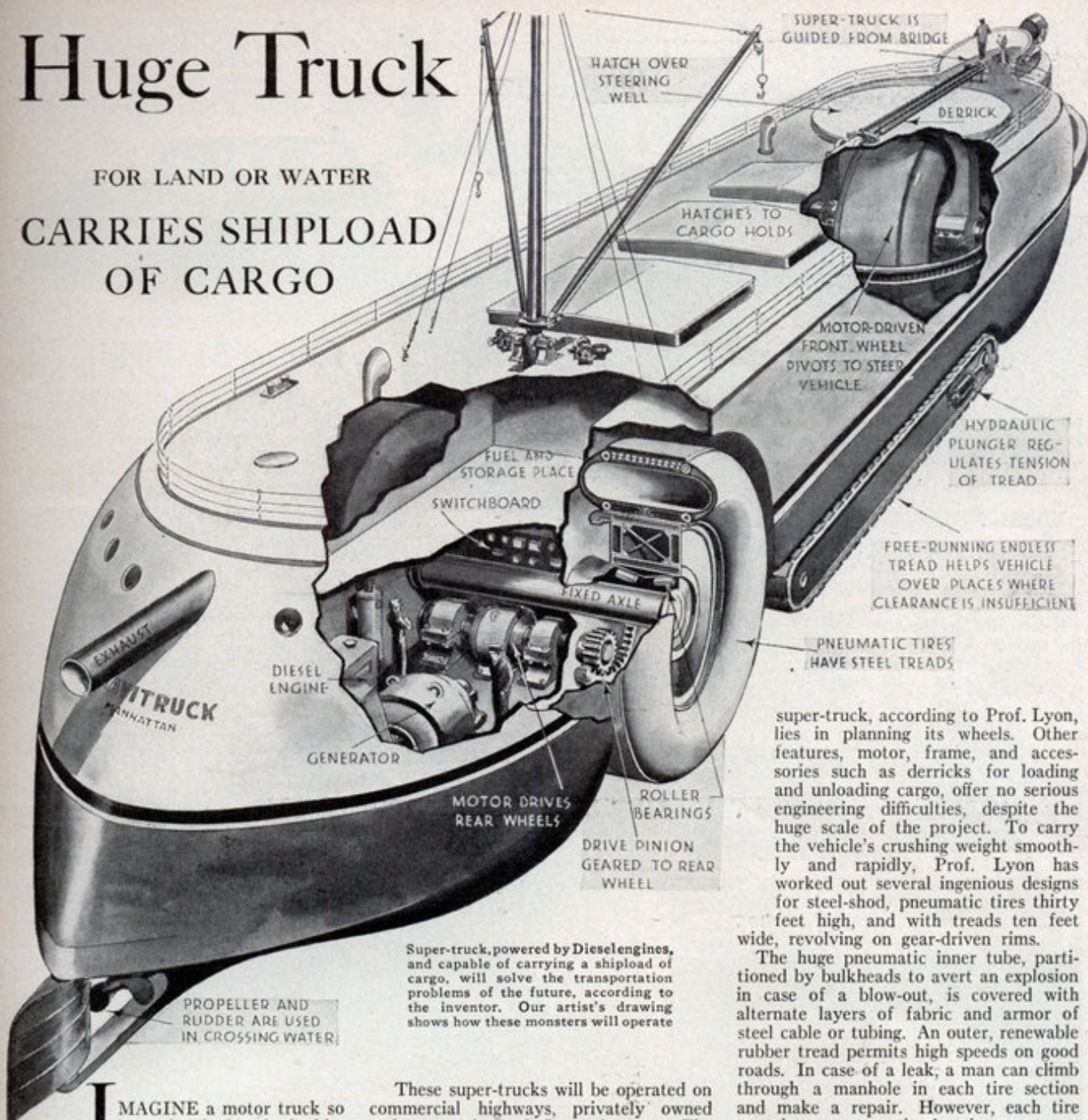




Huge Truck

FOR LAND OR WATER

CARRIES SHIPLOAD
OF CARGO



Super-truck, powered by Diesel engines, and capable of carrying a shipload of cargo, will solve the transportation problems of the future, according to the inventor. Our artist's drawing shows how these monsters will operate

These super-trucks will be operated on commercial highways, privately owned and operated, Prof. Lyon foresees. The roads, needing only to be sanded or graveled, can be constructed at one-third the cost of building a railway. No bridges are required; the super-trucks will ford all streams. In a real sense they will be "land ships," since each one carries as much load as a fair-sized cargo vessel; and both the operating plans and the freight charges will approximate those of water-borne shipping.

Super-trucks will prove their worth especially in the western United States, Prof. Lyon predicts; while they also offer a means of opening inaccessible regions of Canada, Asia, Africa and South America, rich in mineral and other resources, to commerce. A sloping prow at the front of the machine will serve as an ice-breaker, or will clear the way over infrequently-traveled trails through tropical jungles.

The principal problem in projecting a

super-truck, according to Prof. Lyon, lies in planning its wheels. Other features, motor, frame, and accessories such as derricks for loading and unloading cargo, offer no serious engineering difficulties, despite the huge scale of the project. To carry the vehicle's crushing weight smoothly and rapidly, Prof. Lyon has worked out several ingenious designs for steel-shod, pneumatic tires thirty feet high, and with treads ten feet wide, revolving on gear-driven rims.

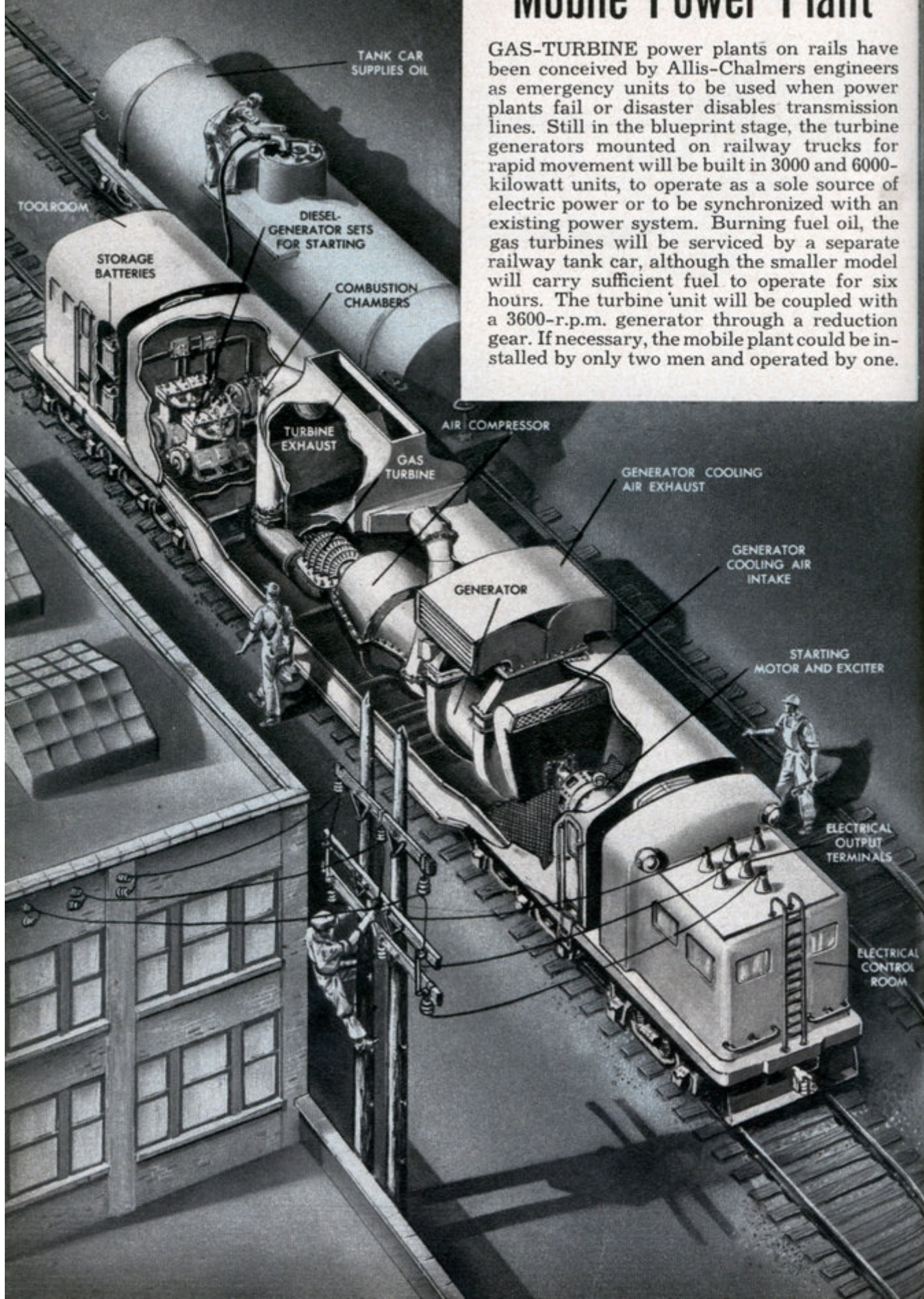
The huge pneumatic inner tube, partitioned by bulkheads to avert an explosion in case of a blow-out, is covered with alternate layers of fabric and armor of steel cable or tubing. An outer, renewable rubber tread permits high speeds on good roads. In case of a leak, a man can climb through a manhole in each tire section and make a repair. However, each tire contains an automatic electric compressor that will maintain the required sixty pounds' pressure despite all but the severest leaks. An auxiliary endless tread amidships helps the super-truck over obstacles in its way.

Roads suitable for the super-trucks will be forty feet wide for one-way traffic and eighty feet wide for two traffic lanes, Prof. Lyon estimates. They will be easy to maintain in good condition, since the massive wheels of the monster truck act as road-rollers and pack the surface more firmly each time they pass over it. Super-highways of this type will be constructed, Prof. Lyon predicts, radiating from Denver, Colo., to Duluth, Minn.; to Kansas City, Mo.; to Galveston, Tex.; and, by way of Santa Fe, N. M., and Phoenix, Ariz., to Los Angeles, Calif. He also predicts a super-highway for the giant trucks from Canada to Mexico by way of the 100th meridian.

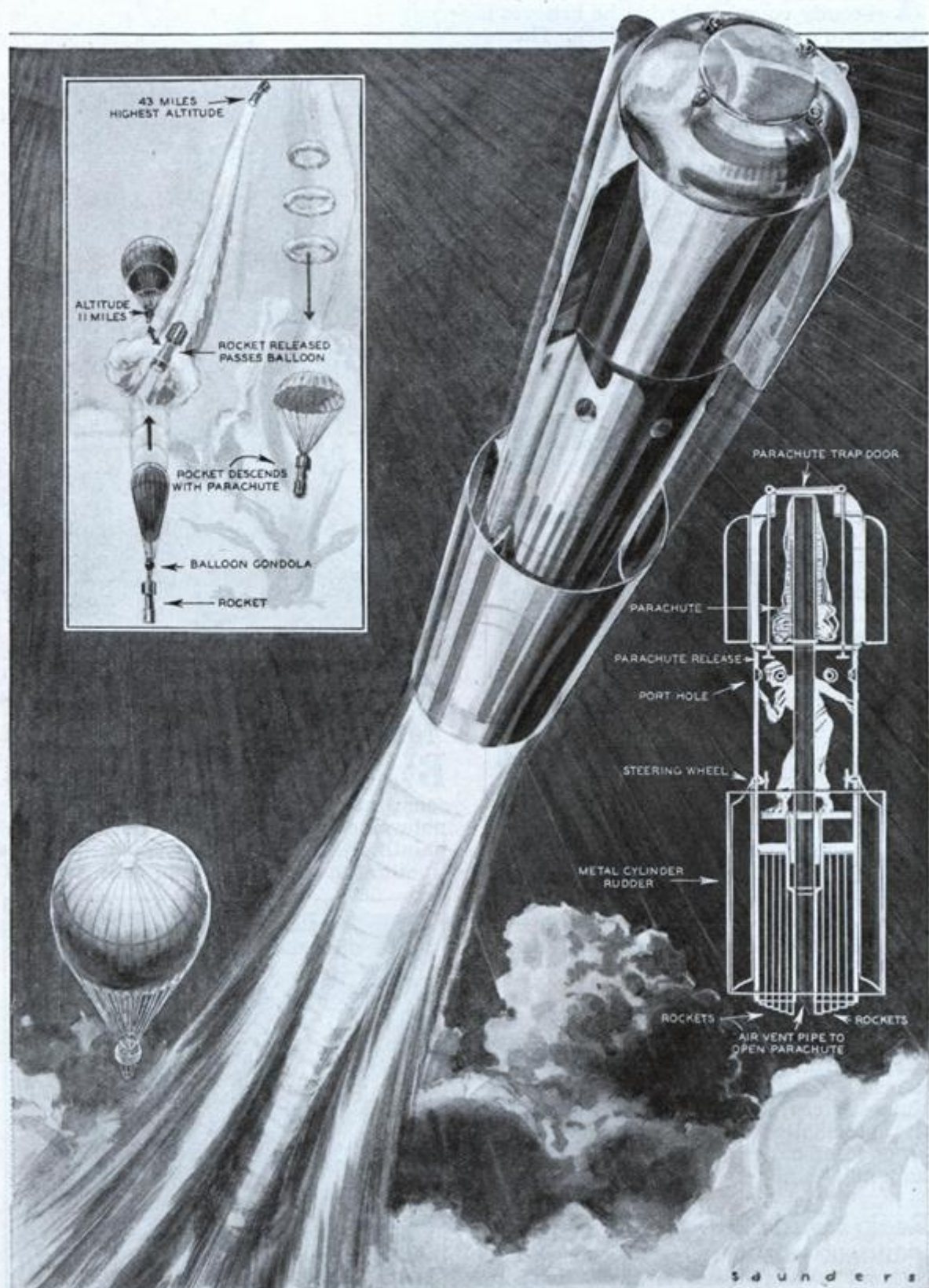
IMAGINE a motor truck so large that it dwarfs the biggest locomotive in the world—a veritable ship of the land, rolling on pneumatic tires as high as a bungalow. Fit this juggernaut, in your mind's eye, with a boat-like hull, a Diesel motor, and an electric drive; add a propeller and rudder so that it can navigate in the water as well as on dry ground; fill its capacious hold with hundreds of tons of cargo, and send it roaring across the continent or through a wilderness to its destination. Then you will have a mental image of the 1,500-ton, amphibian super-truck that Eric R. Lyon, associate professor of physics at the Kansas State Agricultural College, predicts will be the freight-carrying vehicle of the future. To prove it feasible, he himself has worked out the engineering design of such a machine, which he calls the "navitruck," and which our artist illustrates here and on the cover of this issue.

Mobile Power Plant

GAS-TURBINE power plants on rails have been conceived by Allis-Chalmers engineers as emergency units to be used when power plants fail or disaster disables transmission lines. Still in the blueprint stage, the turbine generators mounted on railway trucks for rapid movement will be built in 3000 and 6000-kilowatt units, to operate as a sole source of electric power or to be synchronized with an existing power system. Burning fuel oil, the gas turbines will be serviced by a separate railway tank car, although the smaller model will carry sufficient fuel to operate for six hours. The turbine unit will be coupled with a 3600-r.p.m. generator through a reduction gear. If necessary, the mobile plant could be installed by only two men and operated by one.

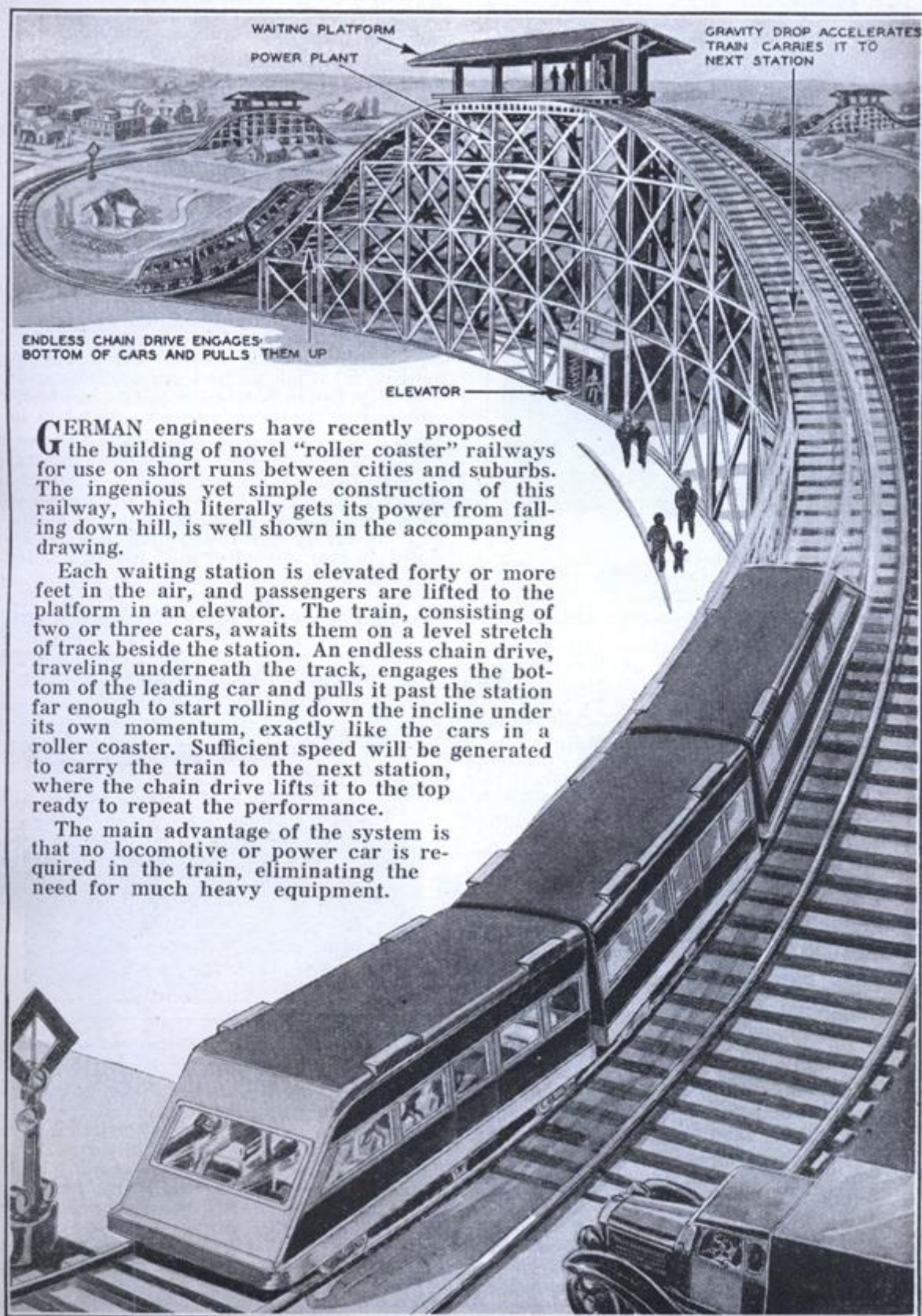


Balloon-Rocket to Soar 43 Miles



A balloon-rocket conceived by a Wyoming inventor is expected to roar 43 miles into the stratosphere. Carried 11 miles by the balloon, the operator cuts loose, ignites two opposed rockets and soars 33 miles higher. One mile is lost cutting away from the balloon. When the rocket power is expended, an air vent is opened, filling a parachute which floats the tube to earth. Inserts show release of rocket and details of the operating mechanism of the cylinder.

A RAILWAY that FALLS Down Hill



GERMAN engineers have recently proposed the building of novel "roller coaster" railways for use on short runs between cities and suburbs. The ingenious yet simple construction of this railway, which literally gets its power from falling down hill, is well shown in the accompanying drawing.

Each waiting station is elevated forty or more feet in the air, and passengers are lifted to the platform in an elevator. The train, consisting of two or three cars, awaits them on a level stretch of track beside the station. An endless chain drive, traveling underneath the track, engages the bottom of the leading car and pulls it past the station far enough to start rolling down the incline under its own momentum, exactly like the cars in a roller coaster. Sufficient speed will be generated to carry the train to the next station, where the chain drive lifts it to the top ready to repeat the performance.

The main advantage of the system is that no locomotive or power car is required in the train, eliminating the need for much heavy equipment.

Operating details of the roller-coaster railway proposed by German engineers. A train gathers speed by plunging down the incline from the station, carrying it to the next station where it is hauled to the top by a chain drive.

Flying

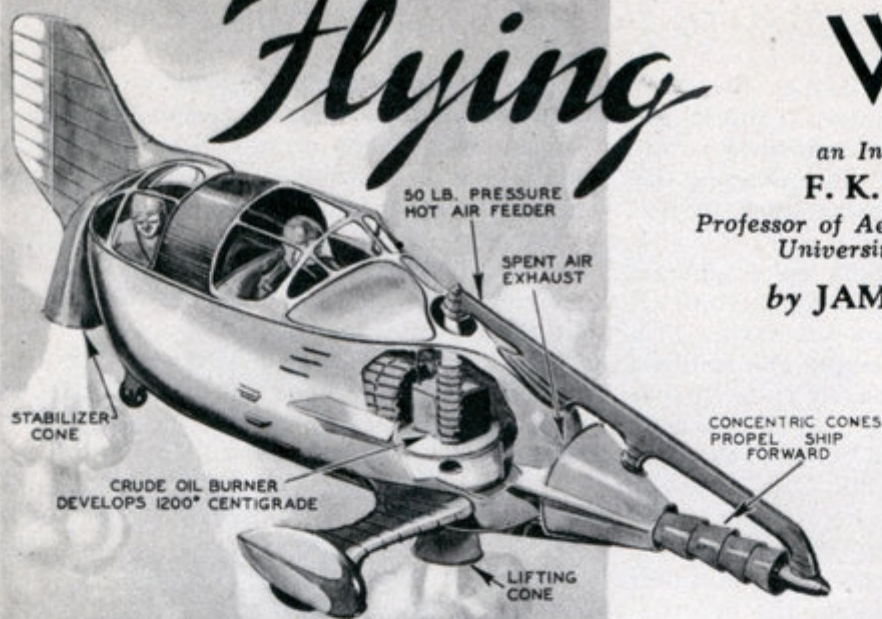
Without

an Interview with

F. K. KIRSTEN

Professor of Aeronautical Engineering
University of Washington

by **JAMES BOWLES**



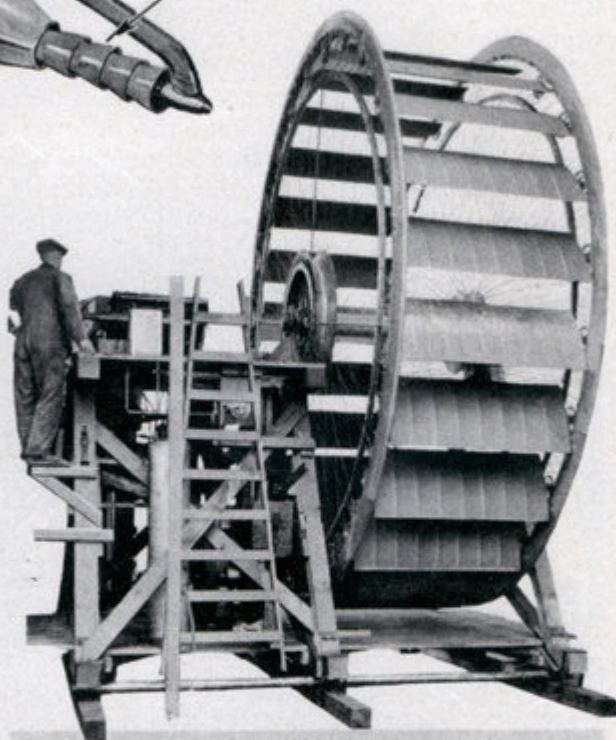
The wingless-motorless craft being developed in France is visualized by an artist in the drawing above. Details have not been revealed, but the ship is known to have a burner which forces hot air through conduits to lifting and propelling cones. Fifteen cones in front of the pilot's cockpit and one in the rear lift the ship, while those in the nose pull the ship forward. Hot air forced through the cones causes suction at the wide ends. The ship, invention of Paul Dupuy DeRolleghem, is expected to have a cruising speed of 120 m.p.h.

EDITOR'S NOTE: Prof. Kirsten has been experimenting with cycloidal propulsion for years both in the aeronautical and marine fields. His work has attracted wide attention, as well as the financial assistance of W. E. Boeing, noted airplane manufacturer.

PICTURE yourself soaring over the Rockies in an airplane without fixed wings, with no propeller as you know the air screw today, yet climbing, diving, dashing ahead in level flight or actually stopping after the manner of a giant insect.

There you have a pre-view of tomorrow's flight possibilities in heavier-than-air machines. Recently developed devices known as cycloidal propellers, projecting outward from the fuselage in the places where wings now are attached, serve not only to pull the cyclocopter, the name given this machine, forward and up, but also to serve as both wings and air brakes when coming down to a safe three-point landing. This machine may be equipped with a standard propeller in the nose. It then is called a cyclo-gyro.

For 15 years Prof. F. K. Kirsten of the University of Washington has investigated the possibilities of cycloidal propulsion and sus-



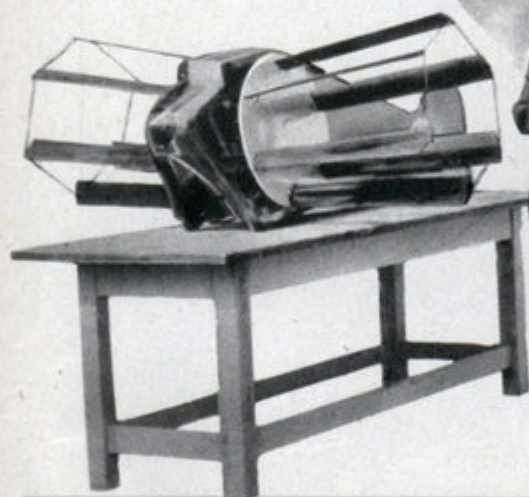
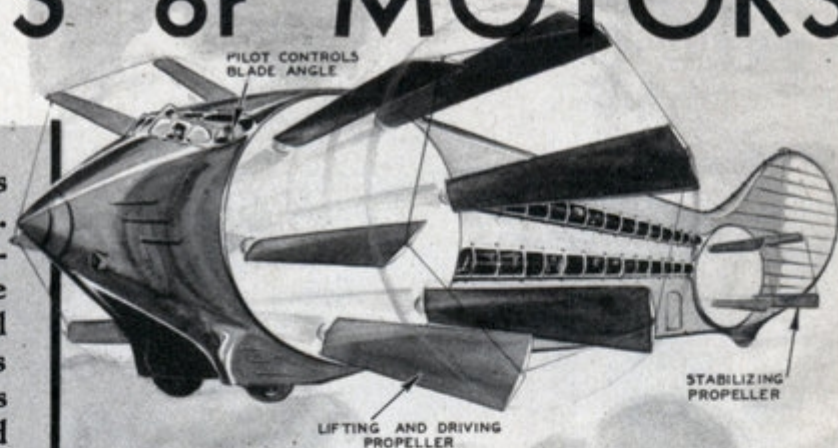
This cycloidal propeller, 15 ft. in diameter, was built for Prof. Kirsten's experiments. It was powered by a 400 h.p. Wright aviation engine. Each blade is 22 inches wide and 54 inches long. It has 24 blades. In tests the entire propeller made about 80 r.p.m.

tentation. It suggested itself to him while he was engaged in an attempt to analyze the flight of birds. Speculation as to the characteristics of the actual path traced in the air by the tip of the bird's wing led him to conclude that this path might resemble the path of a cycloid, which finds expression in the cycloidal propeller, in which several flat surfaces, or wings, are rotated about a center.

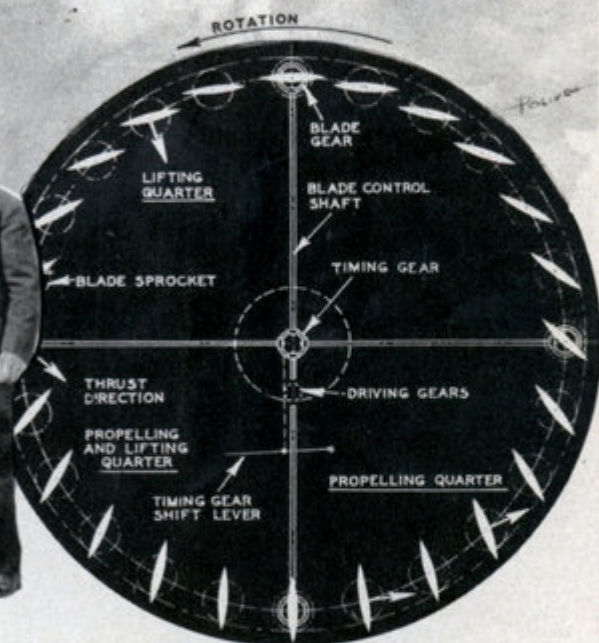
Birds, we know, possess the powers of sustentation—the lift of an airplane wing—and propulsion—speed from the propeller—in the same mechanism, the wings. Too, birds are

WINGS or MOTORS

Airplane design faces radical change. Prof. Kirsten's cycloidal propeller is ready to emerge from the experimental stage into a safe, wingless craft. In Europe ships are being developed eliminating not only wings, but motors also.



Prof. Kirsten is shown above with a model of his wingless cycloidal plane. Above right is drawing of two-deck cycloidal transport that could rise vertically and hover in the air. It would be noiseless.



This diagram is a cross-section view of the cycloidal propeller, showing how blades of the revolving propeller exerted lifting and propelling thrust. The force was then adjusted by changing the blade angle.

far more versatile than airplanes in their ability to take off and land and to engage in rapid flight.

Here is another important point, which in the past has not been even remotely approached in fixed-wing airplanes; birds have neither rudder nor ailerons, although they do possess a horizontal stabilizing fin in the form of tails. They accomplish every manner of control, including pitch, roll and yaw so familiar to airplane pilots, by moving the wing system.

"Thus the new cyclo-copter," Professor

Kirsten told me, "with which we are now experimenting at the Guggenheim Aeronautical Laboratory, University of Washington, possesses a rotating wing-propeller system as in birds and gives us the advantages of free flight enjoyed by those inhabitants of the air.

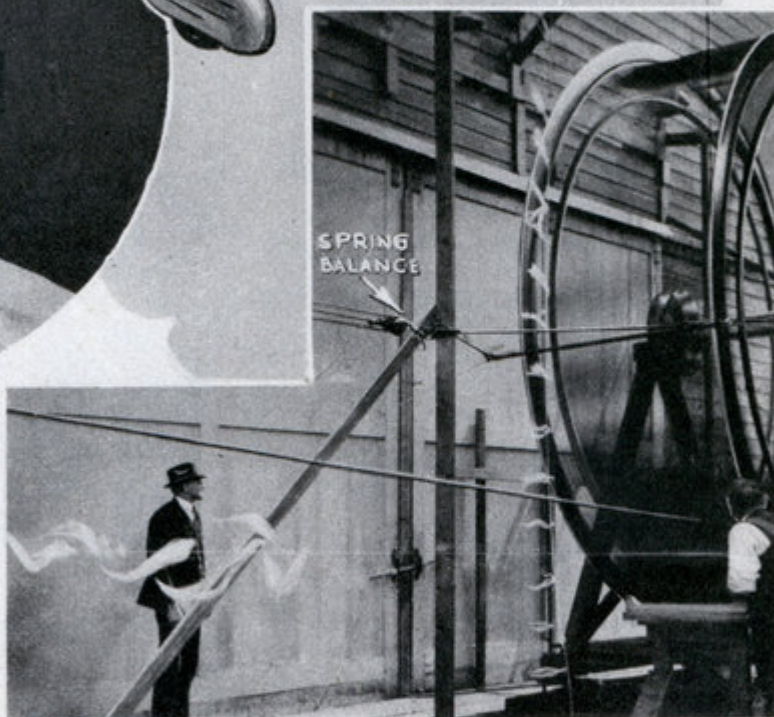
"It's interconnected plane surfaces, representing a bird wing, by their interrelated motions as they revolve, react upon the air in such a way as to derive effects of lift and propulsion quite like those achieved by a bird's wings.

"When fitted as a cyclo-gyro, the air screw

ENDLESS BELT USED IN NEWEST WINGLESS CRAFT



Bemus Johnston (circle) is building an unusual ship at Pittsburgh. As shown in drawing above, instead of wings, his craft will have a series of blades fixed to an endless belt. As the belt whirls the blades are expected to lift the ship. Johnston expects the craft to develop a speed of 500 m.p.h. Right—Prof. Kirsten's cycloidal propeller in operation. The spring balance measured horizontal thrust, while scales under roller supports on one side of the frame determined torque. Streamers were used to indicate direction of air flow. Since revolving blades are invisible, pilot's vision in cyclocopter would not be obstructed.



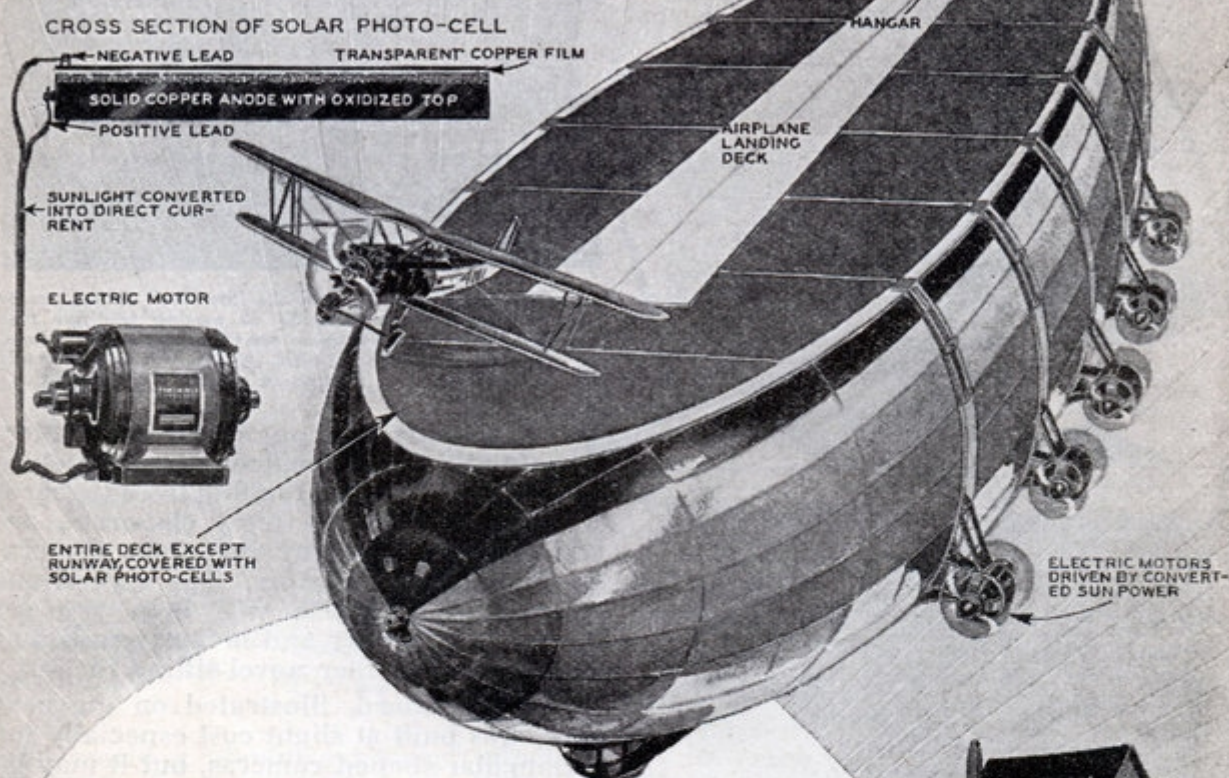
and the cycloidal propellers are turned independently. In this case the air blast from the propeller starts the blades turning. Whereas the screw may turn up to 2,000 r.p.m., the cycloidal propeller will deliver adequate thrust and lift while revolving only 350 r.p.m."

Blades of the cycloidal propeller on this astounding new craft are so arranged mechanically that each makes a half turn for every revolution of the entire propeller. In level flight, for instance, the blade at the bottom of the circle stands on edge, presenting a flat surface to the air stream. This enables it to deliver maximum thrust in pushing the

machine forward. If that blade is moving backward at a rate of 100 miles an hour, the top blade, which is now lying horizontal in the air stream, is moving forward 200 miles an hour with respect to the air—speed of the propeller blades on their orbit plus the speed of the machine which supports it. This gives the top blades four times as great a lift per unit area than for a fixed wing. Together, these tiny wings operate with superior efficiency in propulsions and furnish the required lift at the same time.

"It will not be necessary to fit these machines with propellers," Professor Kirsten
 [Continued on page 127]

SUN'S RAYS TO DRIVE Aerial Landing Field



RECENT experiments in the conversion of the sun's rays into electric power have led to an unusual idea in aerial equipment. It is a dirigible that not only would get its power from the sun but also provide space for a landing field in the air.

The ordinary cigar-shaped dirigible would in effect have a slice taken from the upper half of the gas bag. This would provide a large deck on which could be mounted solar photo cells, an airplane runway, and a hangar. Planes could land on the dirigible, floating over the sea, to refuel for trans-ocean passenger service.

Another unusual feature of this design, in addition to the landing field, is the use of sun rays to power the motors of the dirigible. Scientists estimate that the sun can develop as much as 86,300 kilowatts or 115,000 horsepower per hour in an area of a square mile. Photo cells convert the sun's energy into electricity. When this can be done on a practical basis, the roof of an ordinary house can be used to develop electricity for the home.

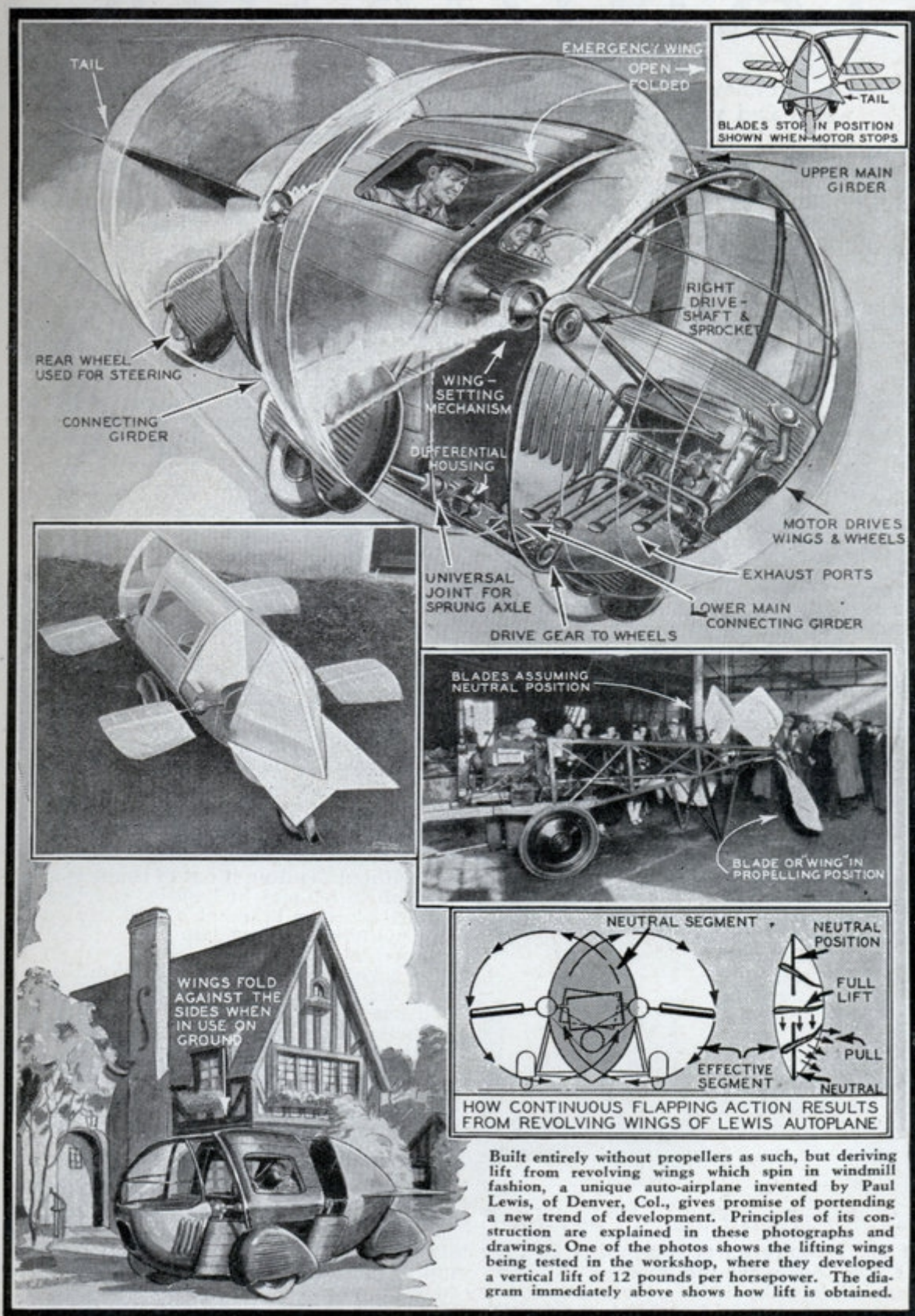


ROOF SPACE OF ORDINARY HOME COVERED WITH SOLAR PHOTO-CELLS COULD DEVELOP CURRENT FOR APPLIANCES AND LIGHTS

MAXIMUM POSSIBLE ENERGY FROM SUN IS 86,300 KILOWATTS PER SQUARE MILE

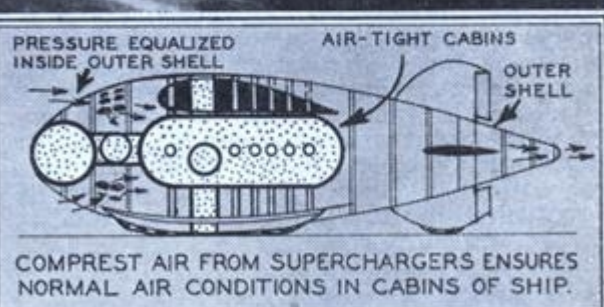
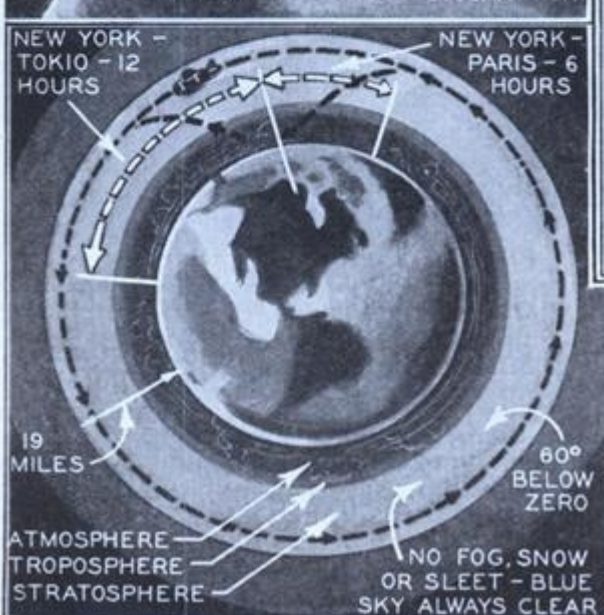
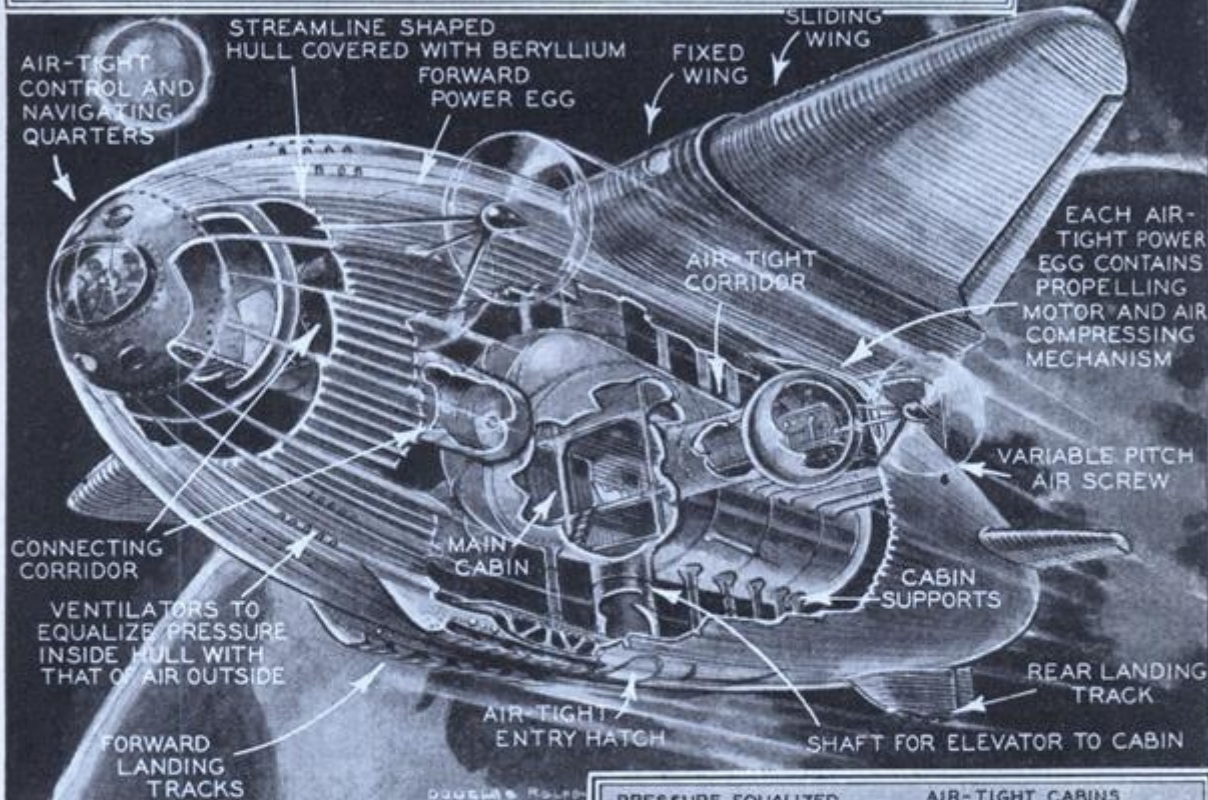
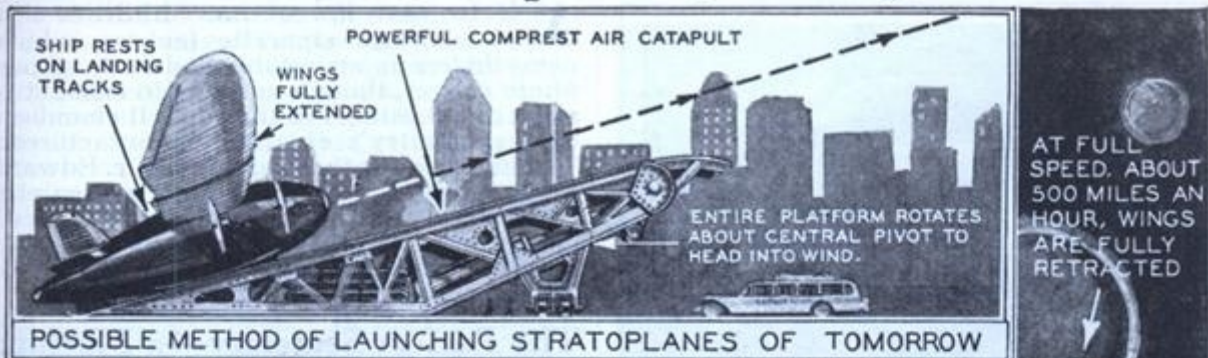


Revolving Paddles Lift Odd-Style Plane



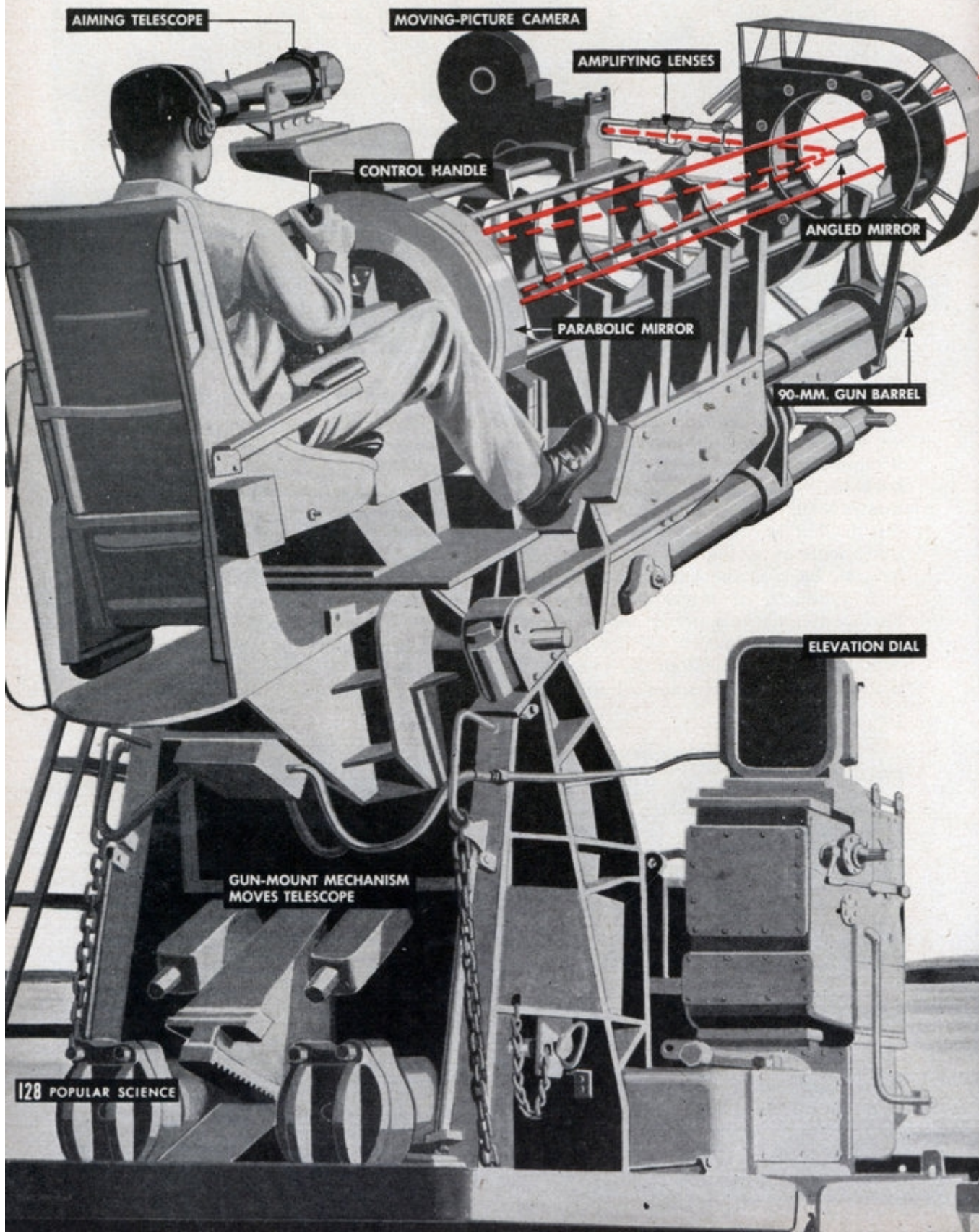
Built entirely without propellers as such, but deriving lift from revolving wings which spin in windmill fashion, a unique auto-airplane invented by Paul Lewis, of Denver, Col., gives promise of portending a new trend of development. Principles of its construction are explained in these photographs and drawings. One of the photos shows the lifting wings being tested in the workshop, where they developed a vertical lift of 12 pounds per horsepower. The diagram immediately above shows how lift is obtained.

Six Hours to Europe in Stratosphere Liner



Traveling three times faster and with greater safety than planes operating in the ordinary air lanes, great air liners of tomorrow will drone through the purple darkness of the stratosphere to connect the principal cities of the world in the space of a few hours, is amazing prediction of Prof. Piccard, conqueror of the upper atmosphere. The greatest obstacles to be overcome, protection against extreme cold, low atmospheric pressure, and the dangerous sun's rays, will likely be conquered by a plane having the features of the ship illustrated in the artist's drawing above. Time between Paris and New York City may be reduced to less than six hours, when the stratosphere plane materializes. The method of launching the stratoliner shown above is a new development, made necessary by take-off difficulties incident to the design of a ship intended exclusively for cruising in thin atmosphere.

Rocket's Flight





LIGHT RAYS FROM ROCKET

Kept In Sight

Gun-mounted camera eye keeps movie record of V-2 missile as it speeds into space at 3,500 miles an hour.

By Martin Mann

POPEYE is a seeing machine. Popeye can see things you can't see. His big glass eye can follow a V-2 zooming 3,500 m.p.h. and tell you just what it does at the 100-mile peak of its flight. But even Popeye is no match for enemy guided missiles—he could not spot an attacking rocket soon enough to sound the alarm.

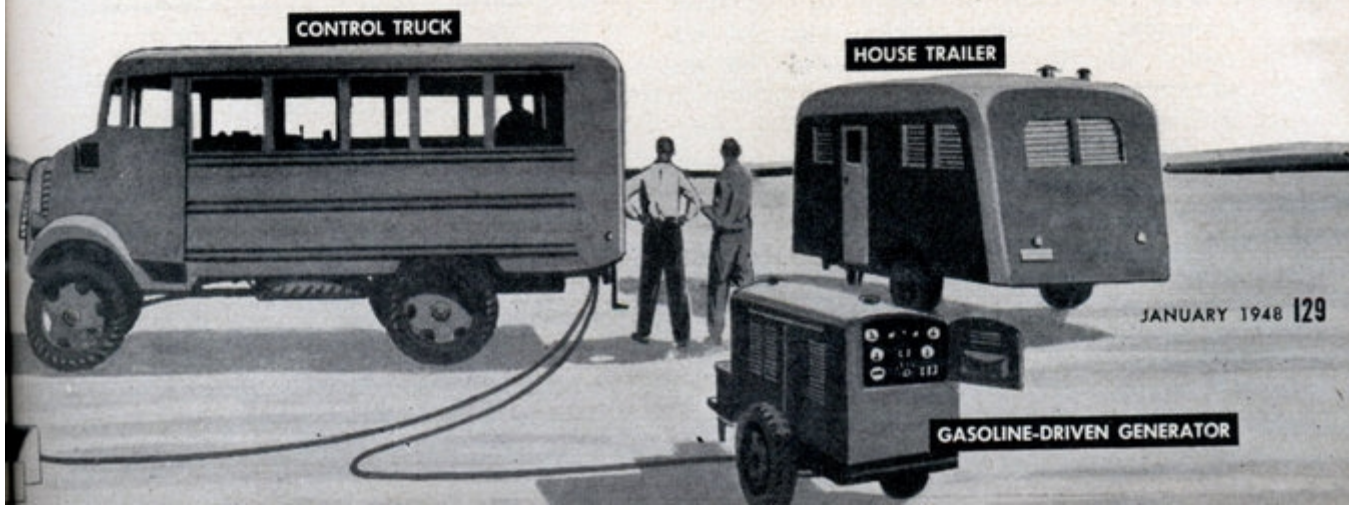
Popeye—as this Rube Goldbergish invention is unofficially known—is a 16-inch-wide parabolic mirror, amplifying lenses, and a movie camera, all mounted on top of a sawed-off 90-mm. antiaircraft gun so that it can follow the fast-moving rockets. Despite its fantastic appearance, Popeye has a serious purpose: to find out what happens to high-altitude rockets after they are fired. It will be used on all kinds of rockets—the new ones made in USA as well as the V-2.

This new telescope, officially known as "Type IV Tracking Telescope," joins an im-

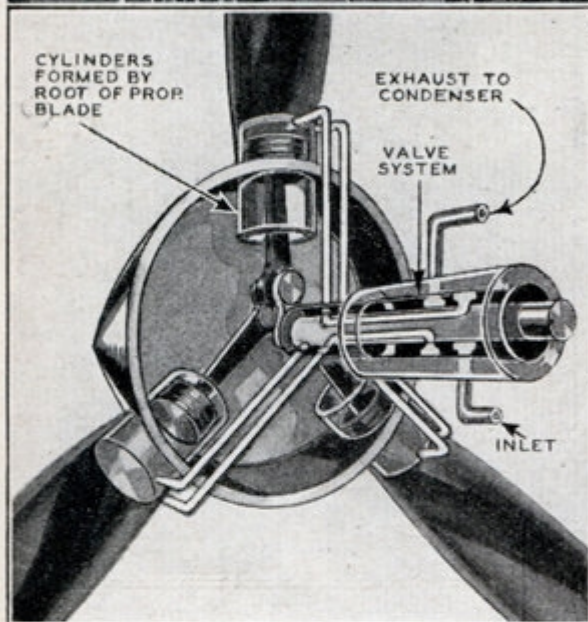
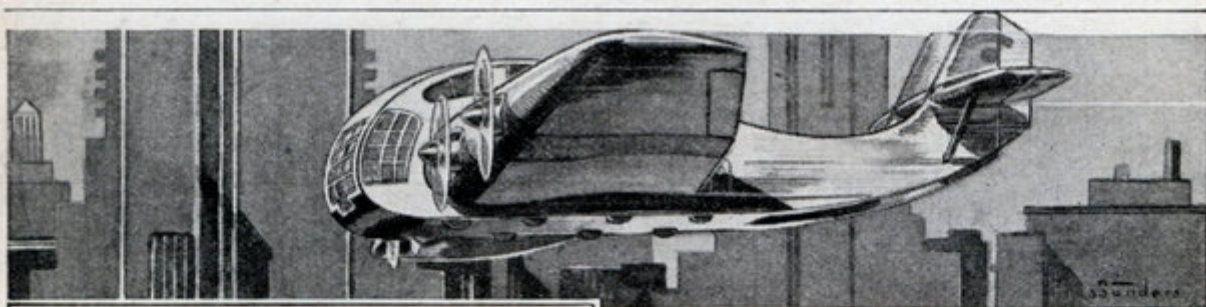
posing battery of optical and electronic "watchers" at the Army Ordnance Department's proving ground at White Sands, N. M., that already includes smaller telescopes, ballistic cameras, phototheodolites, radar, telemeters, and Doppler equipment.

Like Popeye, they are all trying to find out, for every vital second of a rocket's meteoric flight, where the missile is, when it's there, and what it's doing there. These devices are not designed to spot attacking missiles, although one researcher suggests that a big telescope might be fitted with a heat detector (a bolometer or thermocouple) instead of a camera and be used to locate incoming missiles by the heat from their rocket jets.

Astronomers already use such a system to track stars automatically. It would work fine as long as the missile approached along a straight line of sight from high altitudes. But no telescope can see through the earth. An attacking missile might come in to the target at a low level, hidden by the horizon until the last 50 miles or so. At 3,500 m.p.h. a rocket covers those 50 miles in less than one minute!



STEAM Will POWER



The rotary motor is the only perfect power plant using reciprocating motion without reciprocating weight. Here's Hilburn's suggestion for the simplest "irreducible" power plant.

EVERY once in a while we have to "get back to nature"—get back to the simple things our dads used. Often we find that we've been on an engineering merry-go-round and that the old gentlemen who were our forbears had some right good ideas in design, but were unable to use them to the fullest extent of their theories because the right materials were not available in iron, or steel, or something else.

And every so often the subject of what tomorrow's airplane will look like bobs up in some writer's mind. He is usually hard pressed to get something really new to write about, so he lays it on thick and the resulting pipe dream generally makes an air-minded man who has any air "savvy" pretty sick.

Recent developments in engineering activities have brought these two phenomena together again: steam and tomorrow's airplane. Strangely, some real progress has been made, and we find that steam, used by our grand-dads as an old reliable medium, has been put into new clothes by the de-

Central boiler plant will furnish steam to many simple motors in the wing; will heat the cabin comfortably and prevent ice formation on wings in tomorrow's plane.

The oldest prime mover—steam—is staging a comeback. Read what amazingly logical things can be accomplished with new designs in planes through the use of steam as a power plant and control medium.

by **EARL D. HILBURN**
Aeronautical Engineer

velopments in materials to the point where it can be considered within reach on all engineering points to make an ideal power plant for a new airplane which will bristle with logical departures.

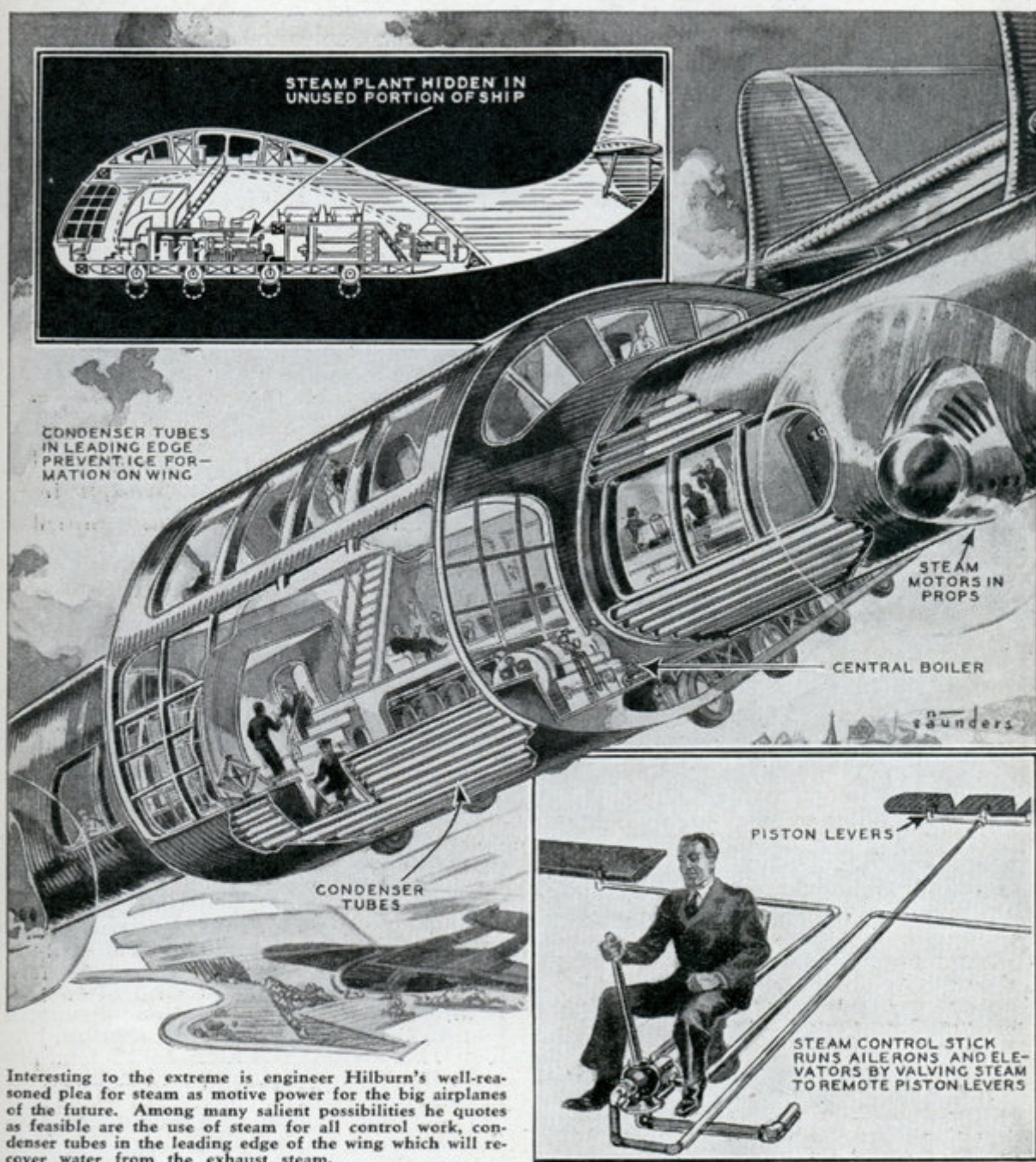
Let us take a fundamental consideration: The power plant of the future Leviathan of the air by necessity must be more powerful than is at present practical to build with the present day highly complicated internal combustion engine. The limit is approached in gas engines when such ships as the Dornier DO-X must use twelve 600 h.p. engines separately mounted with all the mess of gauges, magnetos and so forth that must be duplicated time after time.

Airplane designers are far ahead of engine designers in aircraft developments and many of the leading minds of the engineering world are striving to develop engines of suitable design for tomorrow's airplane needs.

Among them is Capt. Richardson, of the Great Lakes Aircraft Corporation, for whom the aeronautical world has profound respect. Also, working along different lines in this search which points toward steam as tomorrow's motive power is Abner Doble, one of the world's leading authorities on steam.

Whether or not the ultimate power plant will be of the turbine type such as Richardson is developing, or whether the engine will be of the reciprocating expansion type

Tomorrow's PLANES!



Interesting to the extreme is engineer Hilburn's well-reasoned plea for steam as motive power for the big airplanes of the future. Among many salient possibilities he quotes as feasible are the use of steam for all control work, condenser tubes in the leading edge of the wing which will recover water from the exhaust steam.

as is being developed by Doble remains to be determined.

Another consideration at once becomes obvious when we consider the possibilities of the steam power plant.

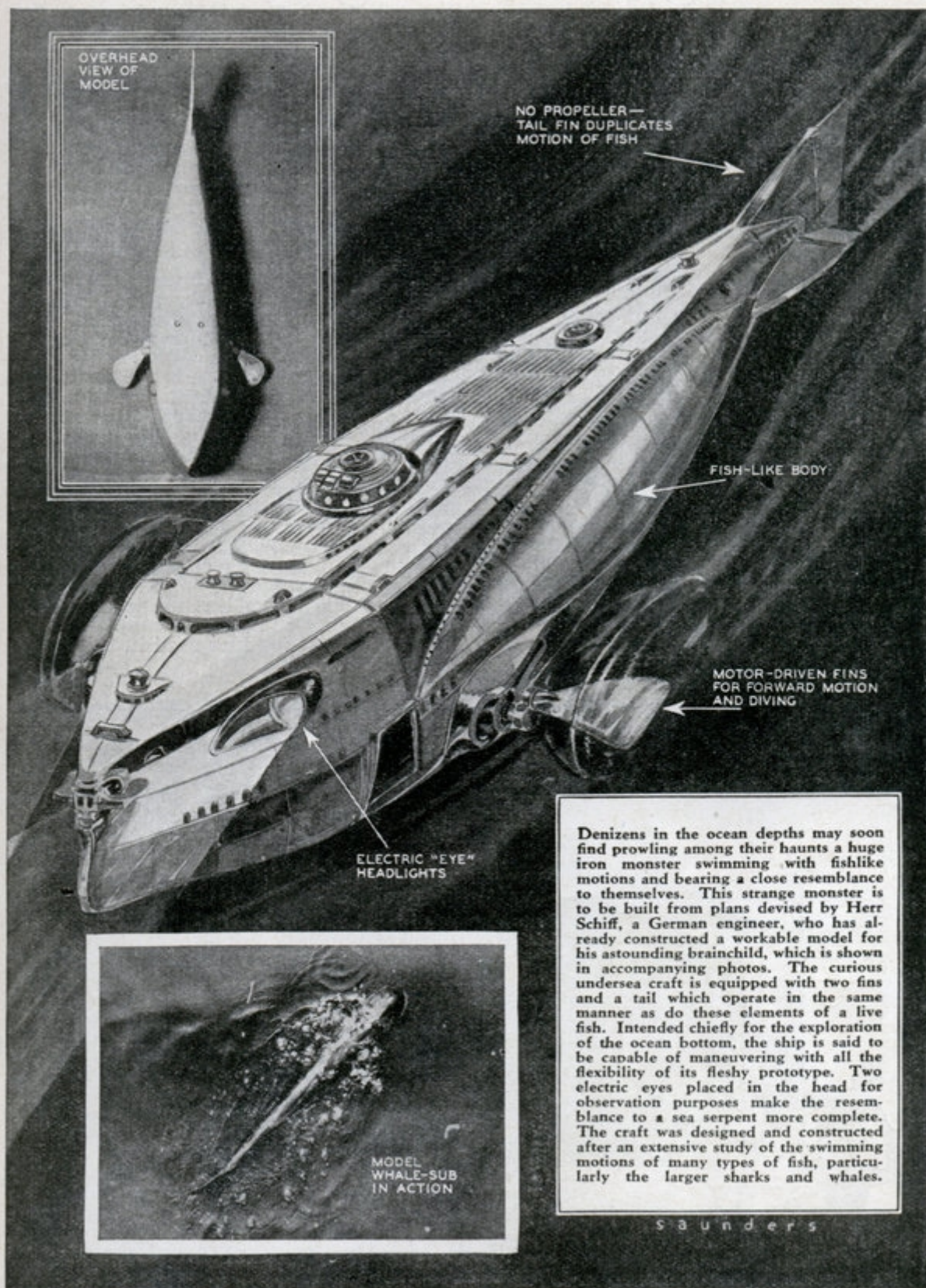
These are the advantages which may be derived from the steam in the operation of controls, combination shock absorbers and retracting devices for landing gear, single throttle for all engines, heating of leading edge and propeller to prevent the forma-

tion of ice, heating of cabins, cooking of meals, generation of electricity for lighting and for radio equipment.

The controls may be operated with the conventional control stick connected to two rotary valves sitting at right angles. The forward movement of the stick rotates the valve which is connected by steam line with the cylinders operating the elevators. The side movement of the stick, in like

(Continued on page 172)

Iron Whale Swims Ocean Bottom Like Fish



Denizens in the ocean depths may soon find prowling among their haunts a huge iron monster swimming with fishlike motions and bearing a close resemblance to themselves. This strange monster is to be built from plans devised by Herr Schiff, a German engineer, who has already constructed a workable model for his astounding brainchild, which is shown in accompanying photos. The curious undersea craft is equipped with two fins and a tail which operate in the same manner as do these elements of a live fish. Intended chiefly for the exploration of the ocean bottom, the ship is said to be capable of maneuvering with all the flexibility of its fleshy prototype. Two electric eyes placed in the head for observation purposes make the resemblance to a sea serpent more complete. The craft was designed and constructed after an extensive study of the swimming motions of many types of fish, particularly the larger sharks and whales.

saunders

At top is seen model of the iron whale ready for a test trip. Note the fish-like fins and the two electric eyes set in the head section of the body. At bottom may be seen the model preparing to submerge to prove the practicability of the plans.

MECHANIX ILLUSTRATED

AUGUST

15^c

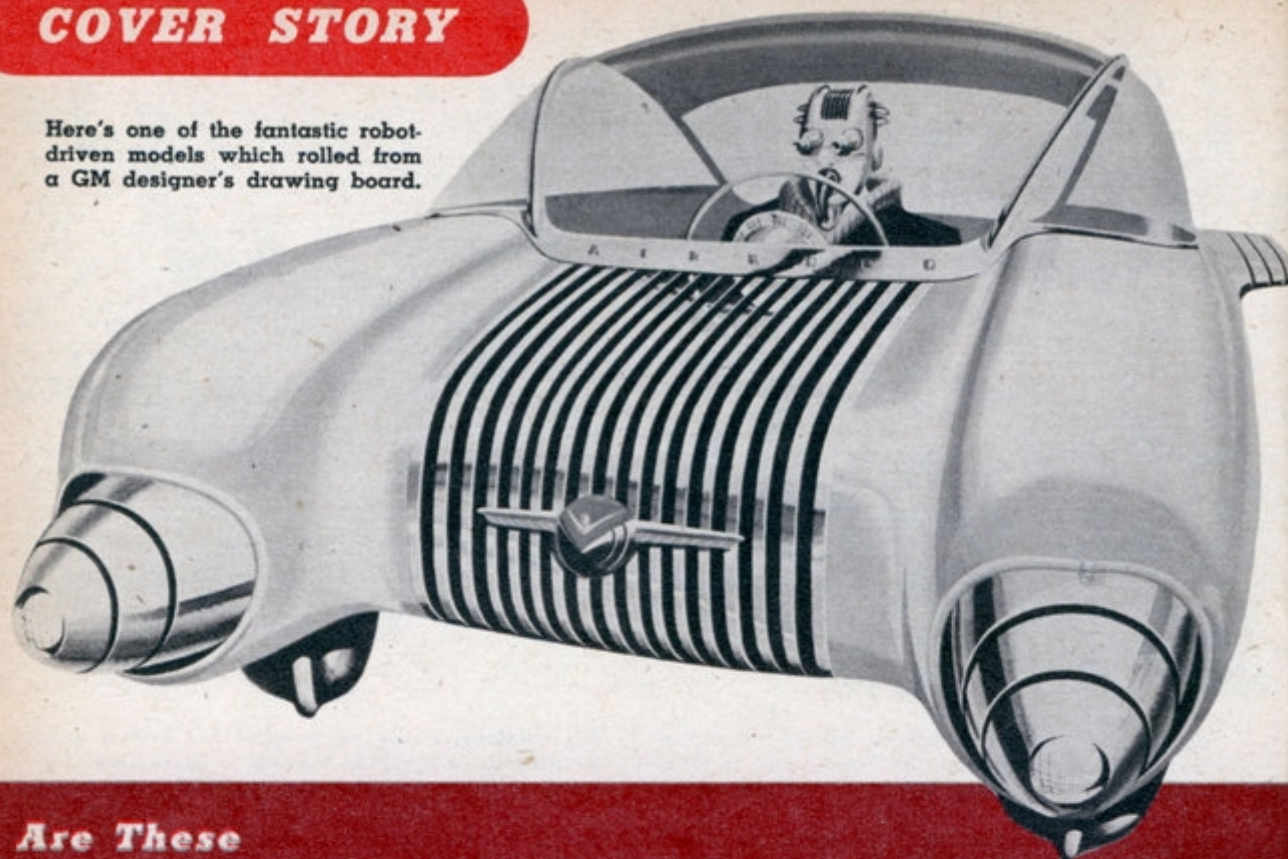


**GM's Car
of Tomorrow?**

See Page 84

COVER STORY

Here's one of the fantastic robot-driven models which rolled from a GM designer's drawing board.



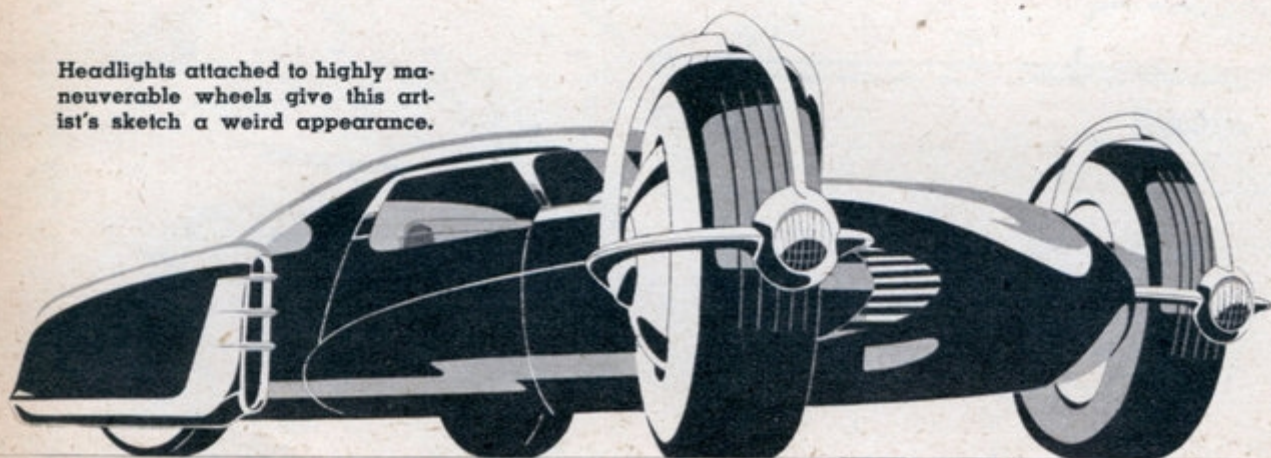
Are These GM's Cars of Tomorrow?

By Bernard W. Crandell

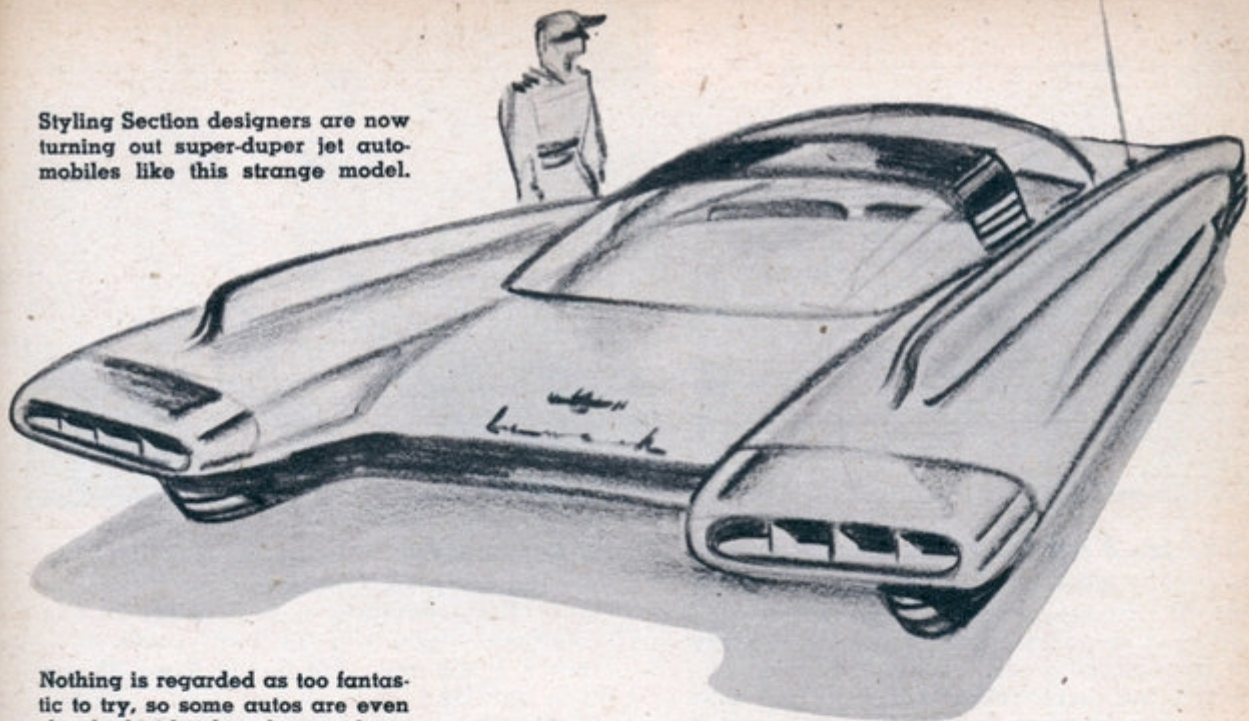
PROBABLY you'll never see any of the fanciful sketches on these pages coming down a production line or in your dealer's salesroom. Nobody at GM intends that you should. The sports car designs here are an important phase of automobile styling done by the General Motors Styling Section and the sketches fulfill a function of professional car designing for which there is no substitute—uninhibited creativeness and daring imagination.

GM designers are developing ideas on paper that run the gamut of futuristic possibilities in autodom—from three-wheel sports runabouts to jet-propelled cruisers steered [Continued on page 158]

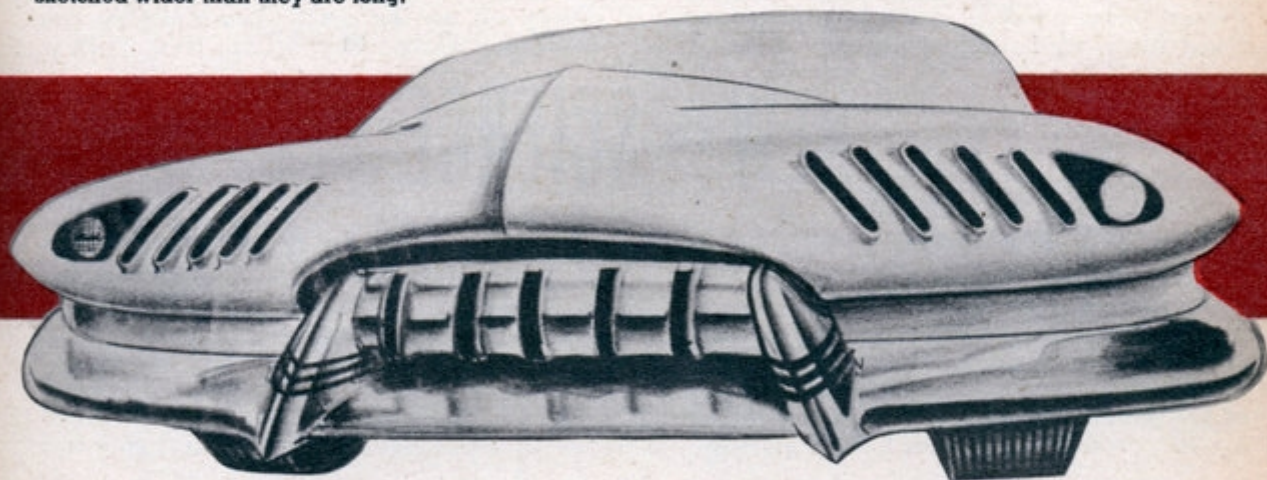
Headlights attached to highly maneuverable wheels give this artist's sketch a weird appearance.



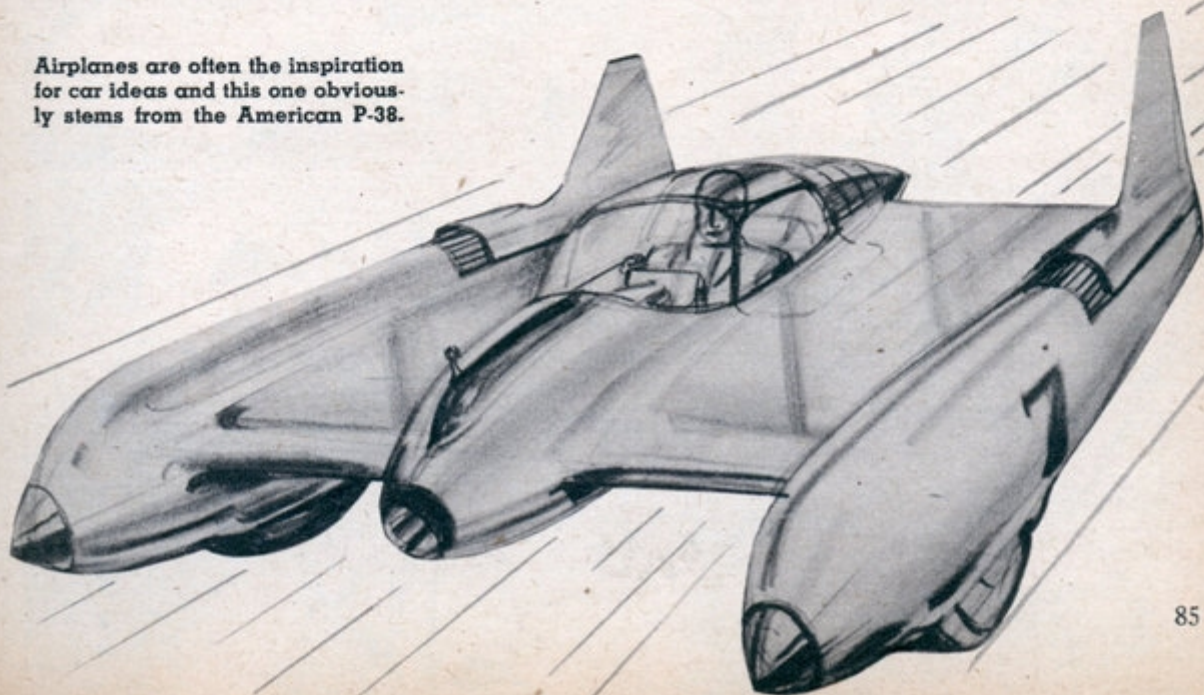
Styling Section designers are now turning out super-duper jet automobiles like this strange model.



Nothing is regarded as too fantastic to try, so some autos are even sketched wider than they are long.



Airplanes are often the inspiration for car ideas and this one obviously stems from the American P-38.

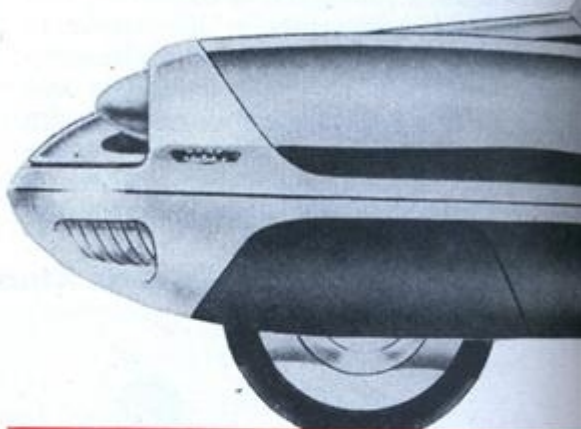
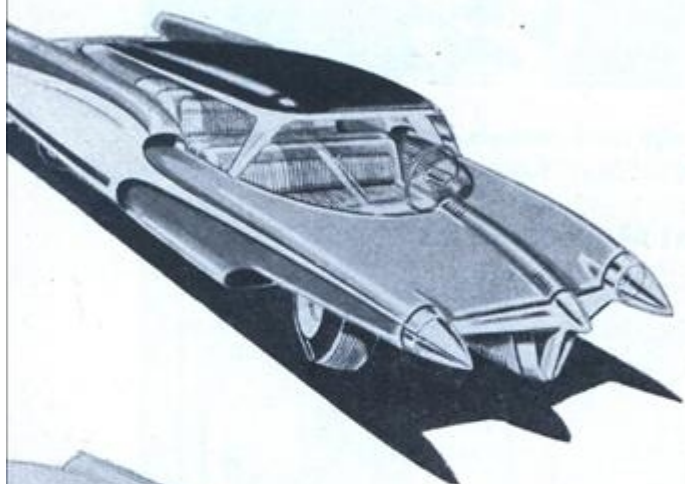




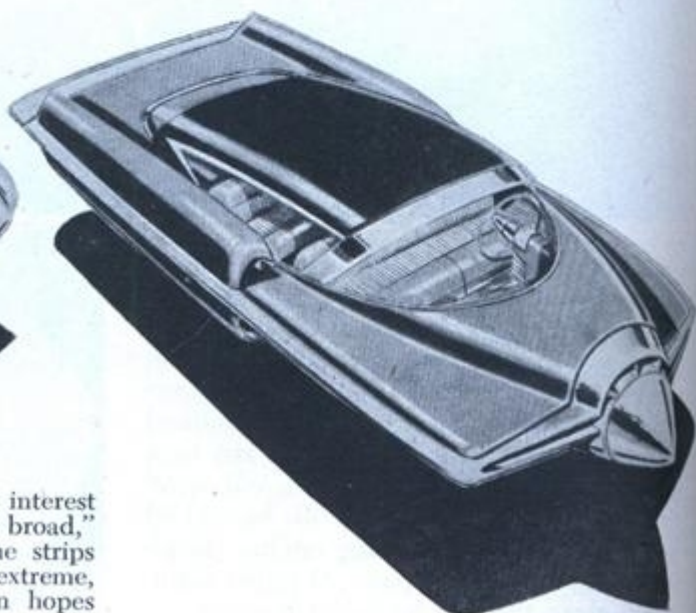
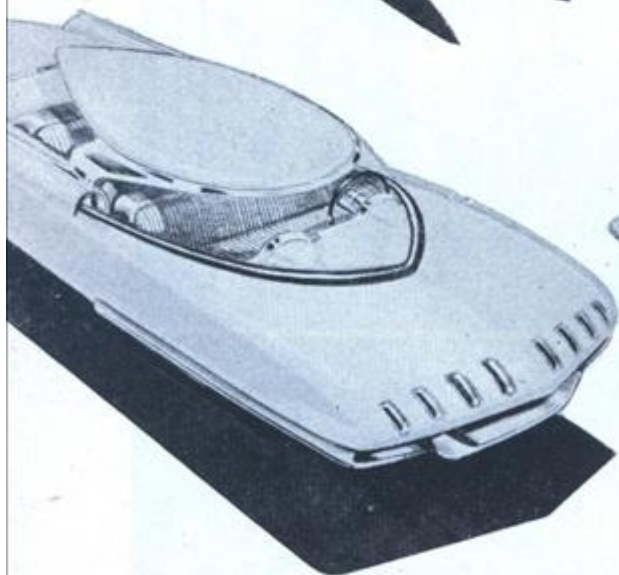
Styling department is Detroit's holy of holies. Doors are locked, guarded. Inside department is *Advanced Styling*. Only Ford officials can get in there.

The Dreams

THE automobiles you see pictured here will never be built. They are dream cars from the Advanced Styling Studio of the Ford Motor Co. The studio's artists drew them as a free exercise in imagination.



In dream car above artist was looking particularly for fresh treatment of top and door. Gil Spear, Advanced Styling supervisor, com-



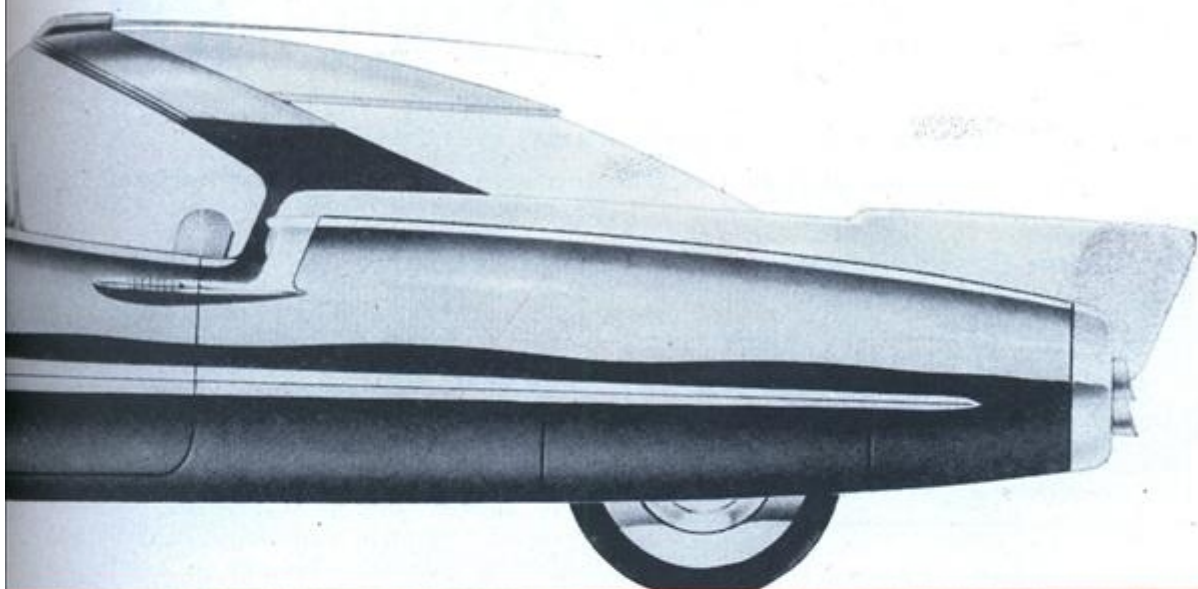
Of these three cars, Artist Spear took interest only in center one. "But the hood's too broad," he commented, "even with the chrome strips to break up its expanse." However extreme, the drawings are carefully studied in hopes they will contain new ideas.

that Make the Fords

A dozen artists and four clay modelers dream up cars like this day in and day out. They have one of the world's pleasantest chores. Their only assignment is to produce new styling ideas. And they do—some 300

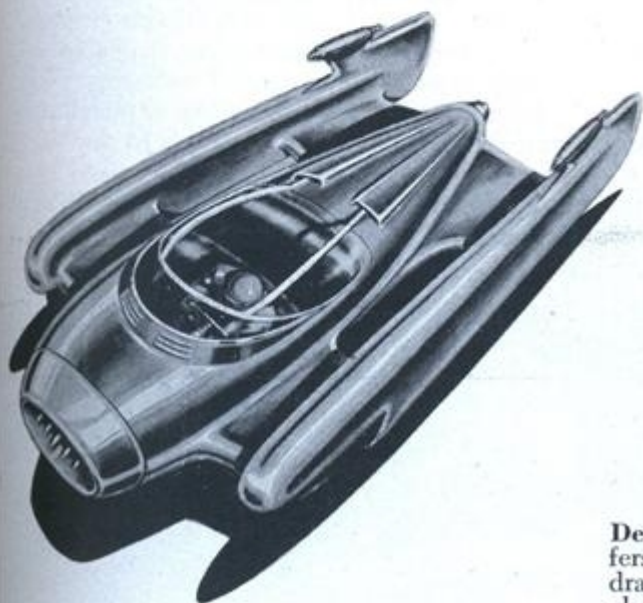
never-never dreamboat designs every year.

While these cars will never reach a production line, an idea for a fender curve, radiator grille, or top may be borrowed for a production car in 1955 or 1960. **END**

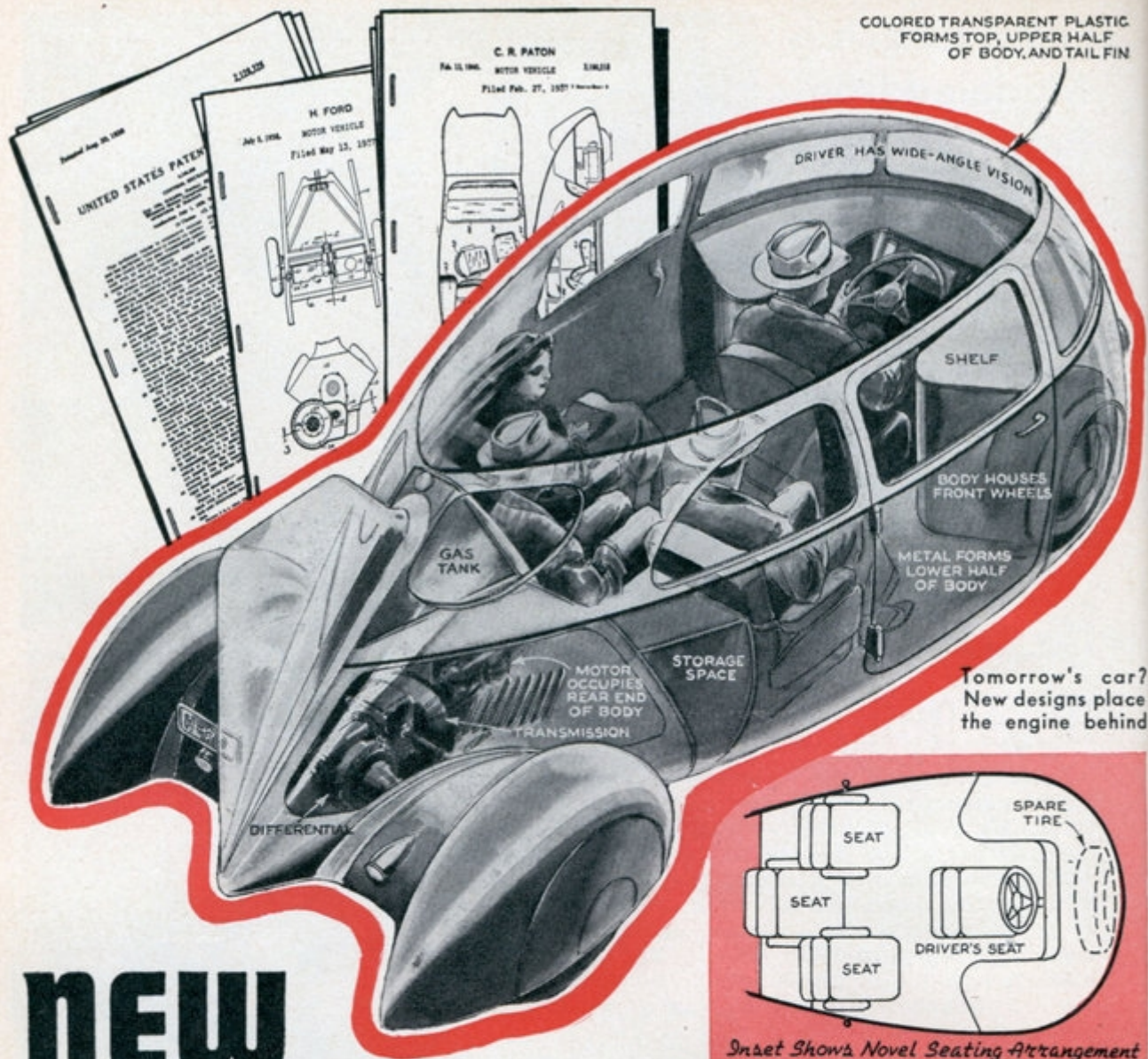


mented: "This door is low enough for a man to rest his arm on. The top has possibilities, but there is too much glass for comfort. The

tail fin is impractical. But I think the idea of admitting cooling air in front through bumper apertures is interesting."



Design at left got no votes. Above, Spear confers with fellow artist over clay model. If a drawing is extra-interesting, it may be put in clay to get three-dimensional perspective.



NEW PATENTS FORECAST



THAT car you'll be buying in 1942—what will it look like? Will it have the engine in the front or in the back? Will it be heavier or lighter, longer or shorter, more or less expensive than the car you're driving now?

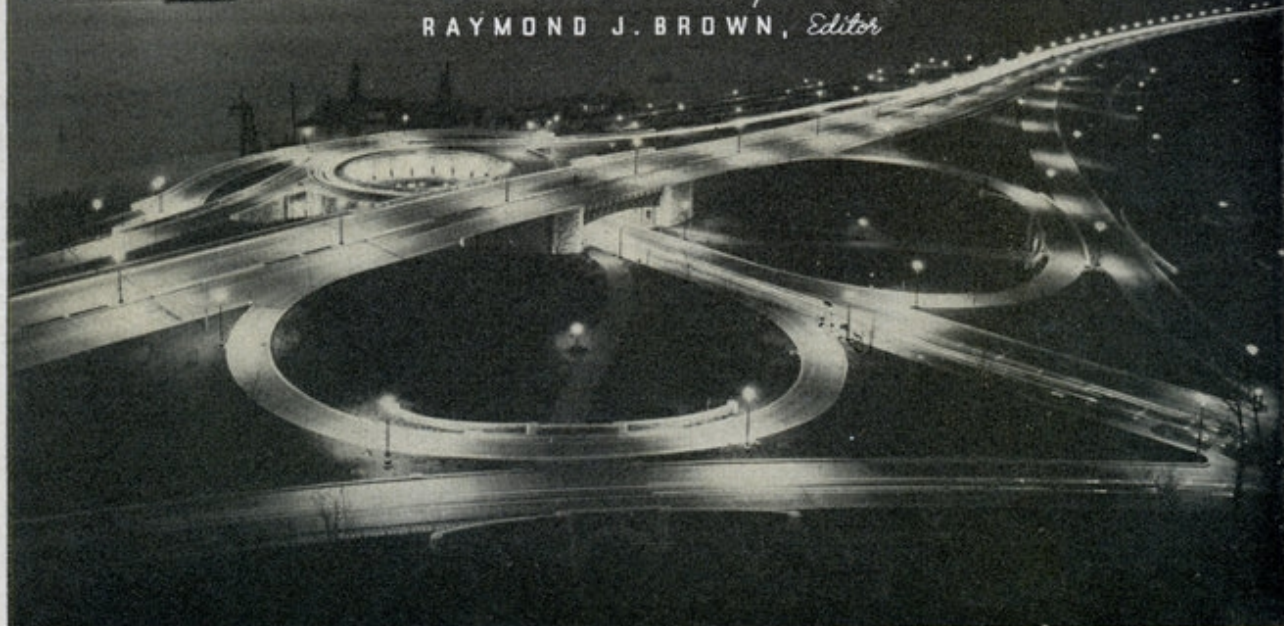
Startling is the only word for the answers to these fascinating questions, as disclosed by an automotive survey just completed by **POPULAR SCIENCE MONTHLY**. Whispers of radical changes and innovations in motor-car design are in the wind, and the recent granting of a series of important automotive patents, every one of which covers a car having its power plant in the back instead of the front, heralds the dawn of a new era in automotive transportation.

Take the advanced car design patented only a few weeks ago and assigned to a leading independent car manufacturer. Streamline from nose to tail, looking like a giant aerial bomb on wheels, this model has its engine lifted bodily from the conventional forward

POPULAR SCIENCE

Monthly

RAYMOND J. BROWN, Editor



Clover-leaf intersections, like this one on the West Side Express Highway in New York City, will be a feature of tomorrow's highways

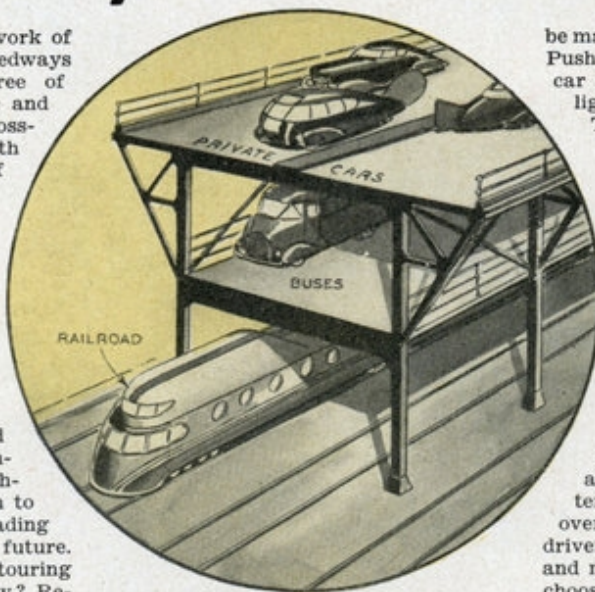
Highways of the Future

PICTURE a 15,000-mile network of twelve-lane motor speedways spanning the nation—three of them linking the Atlantic and Pacific coasts, six more crisscrossing the country north and south—and you will have an idea of the vastness of a spectacular highway plan proposed by Senator Robert J. Bulkley of Ohio.

Requiring twenty-five years for completion, the mammoth gridiron of superhighways would change long-distance driving from a motorist's nightmare of snarled traffic into a reality of fast, safe transportation. It would represent an impressive start toward an era of scientifically constructed speedways, and crash-proof cars of radical new design to run upon them, foreseen by leading experts for the not-too-distant future.

What will transcontinental touring be like, say, fifty years from now? Recently Dr. Miller McClintock, director of the Harvard University Bureau for Street Traffic Research—the man who is recognized as the nation's foremost authority on traffic problems—gave a startling preview of the momentous changes he sees ahead.

Rear-end collisions, he foresees, will



In congested areas, double-deck roadways with separate levels for commercial and pleasure cars may be built over railroads

By
E. W. MÜRTFELDT

be made impossible by a new expedient. Pushing down the brake pedal on a car of the future will operate a stop light that emits infra-red rays. These invisible light rays, picked up and distinguished from ordinary light by a photo-electric cell on the front of a following car, will energize an electric circuit and apply its brakes automatically.

Electric cables, buried beneath the pavements of superhighways, will govern the movement of cars. One set of electromagnetic impulses will control the car's speed. Another set will lock its steering gear against any attempt to make a dangerous turn from one lane to another. Eventually, the cable system may even be adapted to take over steering altogether—allowing the driver to release the wheel, sit back, and make himself comfortable until he chooses to switch back again to manual control.

At night, the superhighways will light up of their own accord, section by section, as a car travels over them. "Electric eyes" spaced along the road will turn on the glareless illumination whenever a car passes, shutting it off at other times to conserve electricity.

Imagine a typical section of this superhighway of the future. Straight as a shaft of light, ten or more broad lanes of concrete stretch across the countryside, passing around cities and towns, bridging railroads, canals, and crossroads. Streamline busses roar along a center strip that splits the speedway, separating streams of private cars traveling in both directions. For cars moving at different speeds, each one-way pavement is divided into separate safety, accelerating, cruising, and express lanes.

Hop into a 1988-model car and take an imaginary spin down one of these amazing foolproof roads. Perhaps you arrived at the transcontinental artery by plane, swooping down on one of the concrete flight strips lining the boulevard, or settling to an automatic, radio-controlled landing on a spacious airport built close to a major highway intersection.

Driving up the clover-leaf approach onto the elevated highway, you glide first into the slow-speed safety lane, edge over into the accelerating strip, and turn the steering wheel to swing into the cruising lane. But nothing happens. Your car refuses to respond

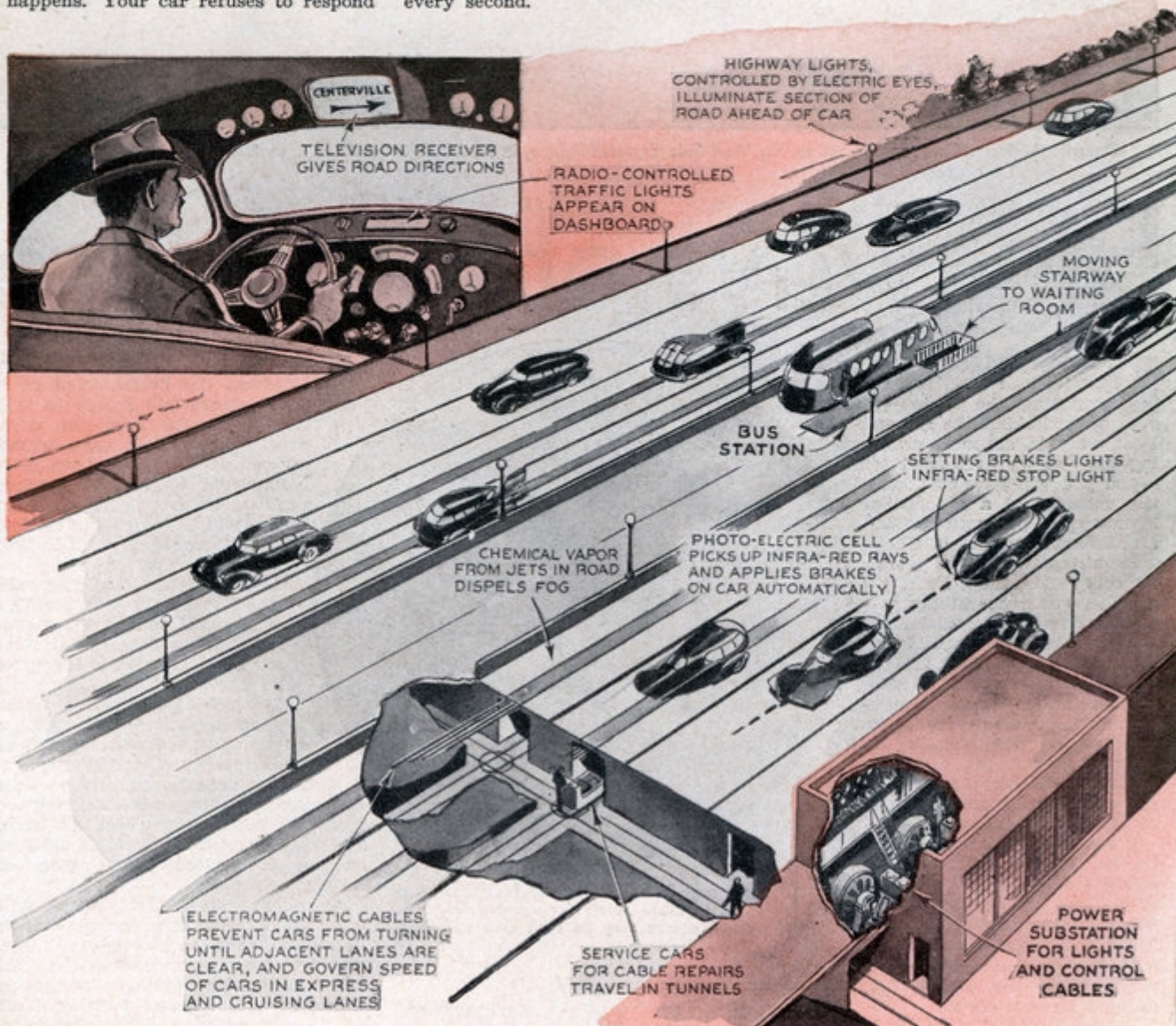
to the wheel, and suddenly you learn why as another automobile whips by on your left at sixty miles an hour. Suspended in service tunnels below the pavement, cables operating on an electromagnetic principle control a mechanism attached to the steering gear to prevent the car from turning left until the adjacent cruising lane is free from traffic for a safe distance.

You try the wheel again. This time the car swings over into the cruising lane and immediately picks up speed. You haven't stepped on the gas, but the speedometer needle creeps steadily upward and freezes on the sixty mark. A second set of buried electromagnetic cables is taking over control of your speed, since cars in the cruising lane must go no more and no less than sixty miles an hour.

But other automobiles are still flying past you on the express lane to your left. Now you swing the wheel over, confident that the car will respond only if turning is safe. In the express lane, your speed automatically steps up to the 100-mile-an-hour limit. Fifty yards of special nonskid pavement flies by underneath your car every second.

Unless you switch back to a slower lane, you can maintain that pace hour after hour, for you'll never see a traffic light, a railroad crossing, a street intersection, or even a curve sharp enough to slow you down. At twilight, overhead lamps will bathe the road in light. Sleet cannot form on the chemically coated windshield of the car. If you run into fog, chemical vapor escaping from tiny jets in the roadway will clear a lane of visibility. So your top speed of 100 miles an hour is also your average speed—fast enough to let you have breakfast in New York, lunch in Ohio, dinner in Iowa, and a midnight snack not far from the Colorado state line.

As your car eats up the miles in the express lane, you notice on your left a steel barrier that divides you from the broad two-way center lane reserved for express bus traffic. Built into the middle of this bus roadway at the outskirts of cities and towns, and at railroad and route junctions, are station platforms, served by moving stairways from waiting rooms below. Here passengers change from interstate busses



Drawing by
B. G. SEIELSTAD

SUPERHIGHWAY SKIRTS
CITIES AND TOWNS

CLOVER-LEAF JUNCTION
FOR RIGHT TURNS ONLY

UNDERPASS
FOR CROSS
TRAFFIC

BUS LANE

EXPRESS LANE

CRUISING LANE

ACCELERATING LANE

SAFETY LANE

PARKING
BAYS



Proposed National Highways

to local lines to be whisked into cities and towns adjacent to the main highway.

Still farther to the left, traffic is speeding along at a controlled pace in the duplicate one-way road section for cars traveling in the opposite direction. But as you marvel at the efficient handling, safety, and speed of this 1938 traffic, it suddenly dawns on you that this superhighway has no roadside markers, no painted warnings on the pavement, not even a signpost to direct you along the route. You search in vain for any of the familiar signs that in 1938 were almost as much a part of the highway as the paving—"Sharp Curve," "Winding Road," "Steep Hill"—these signs, and the necessity for them, have disappeared from main routes years ago.

"But how do I find my way around?" you ask your guide. "How do I know where to turn off for Middletown or Centerville? Is every motorist a mind reader these days?"

Your guide smiles and suggests that you swing off the traveled lanes and nose into one of the parking bays that line the

shoulder of the road. "Take a look at that dashboard," he advises as you pull up to a stop out of the stream of traffic.

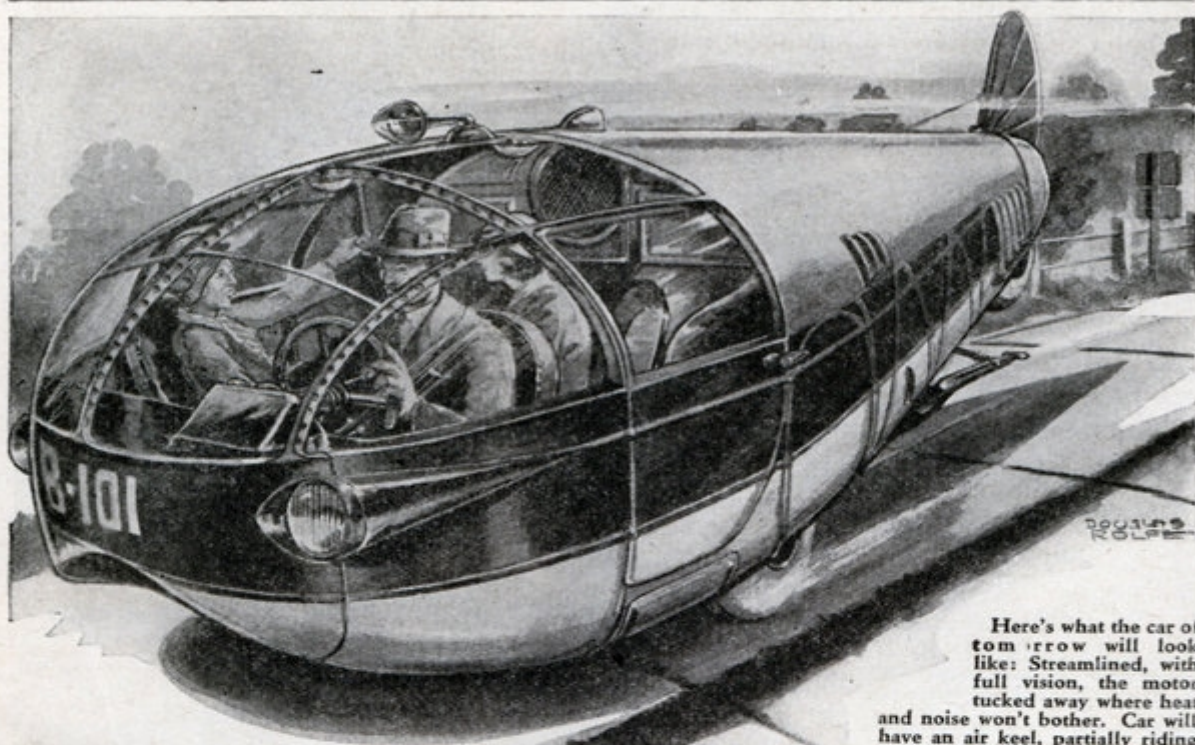
At first glance you spot a few of the familiar dials and instruments—speedometer, fuel gauge, ammeter. After a little study you figure out a few of the others—tachometer, tire-pressure gauge, engine-temperature meter. But what is that row of colored lights, and what is that white screen just over the windshield?

"Since the old days when all cars had gear-shifts and burned gasoline for fuel," he explains, "science has stripped the welter of directional and warning signs off the highway and put the essential ones right on the dashboard of each car. At 100 miles an hour, roadside markers would be no more legible than hen tracks, anyway. The law now requires every automobile to be equipped with standard, pretuned, ultrashort-wave radio and television units. On small four-lane side roads, traffic signals are indicated by the colored lights here on the panel.

"Miles before you reach any superhighway (Continued on page 118)

This is how traffic experts envisage the superhighway of tomorrow. Careful design, and an elaborate system of electrical safety devices, will enable heavy streams of vehicles to move with a minimum of danger even at high speed

The AUTOMOBILE of



Here's what the car of tomorrow will look like: Streamlined, with full vision, the motor tucked away where heat and noise won't bother. Car will have an air keel, partially riding on air, giving infinite wheelbase.

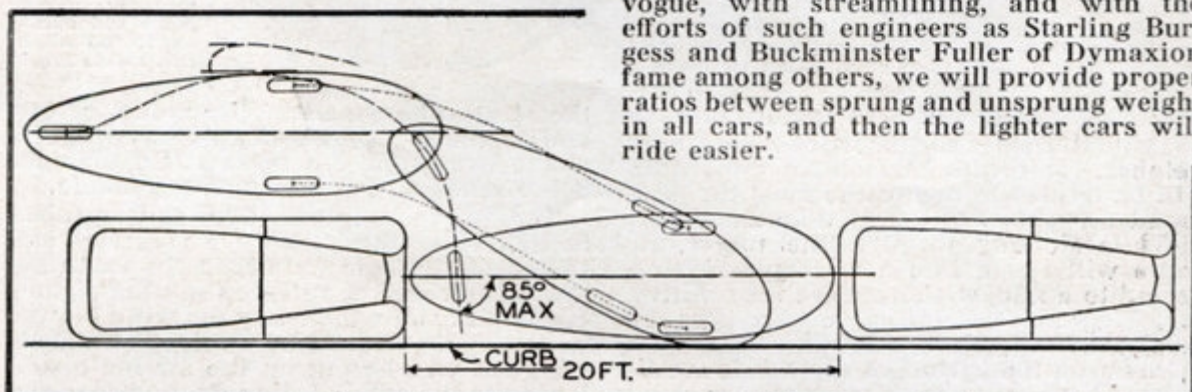


Starling Burgess, standing, and Buckminster Fuller, who have beat the parade to the new car. They are shown at the door of the new Dymaxion transport, already built and tried.

WHAT do I think about the automobile of the future?

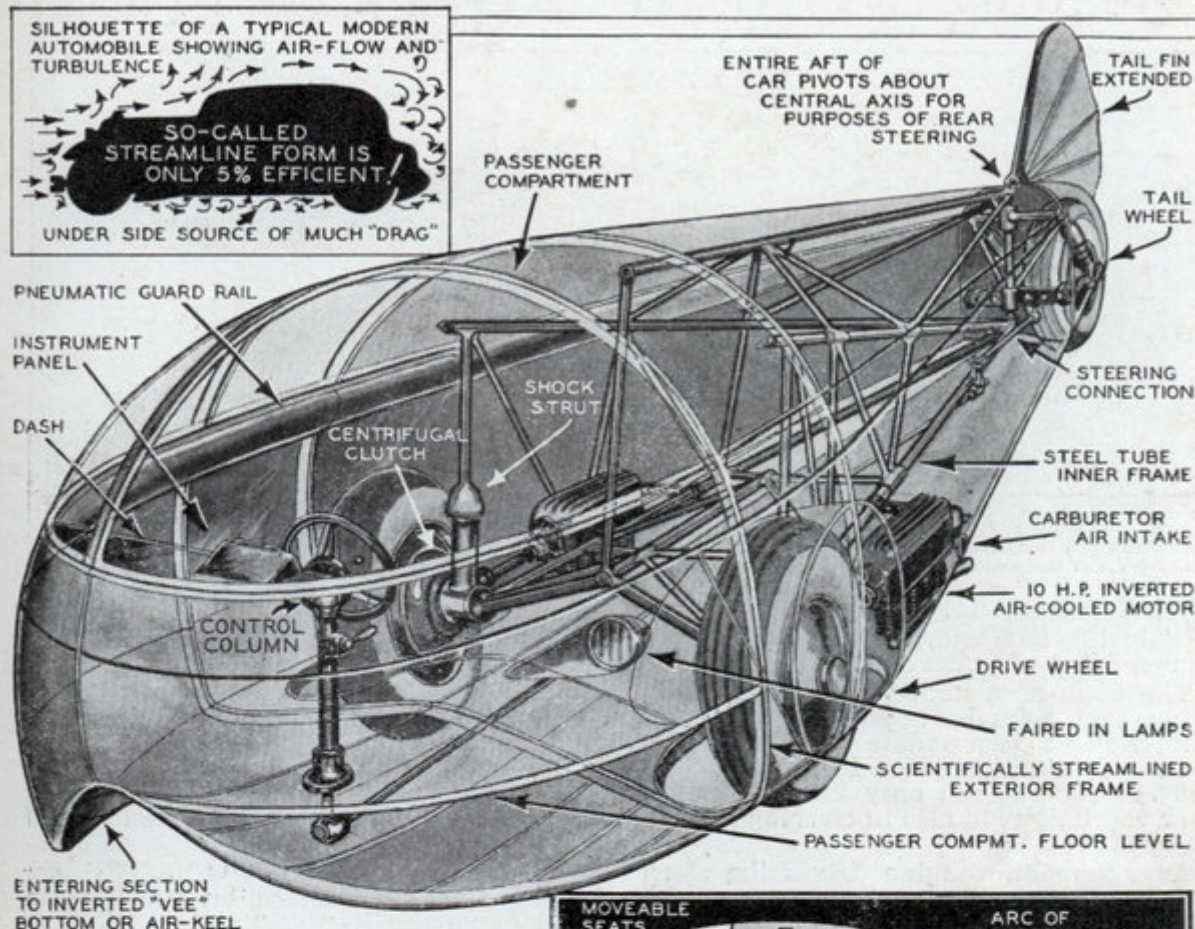
Well, it will be about one-third the weight of the present car and will, of course, be streamlined. The new cars will all weigh less than 2,000 lbs. and will probably have motors of around 100 horsepower. They will be light weight cars, because the lighter the car the easier it rides.

This may sound like heresy in view of the popular supposition that heavier cars ride more easily. But my statement is true. The reason is not that the car is heavier, but that in heavy cars of today the distribution of sprung and unsprung weight accidentally happens to be better. With the new engineering which has been gaining vogue, with streamlining, and with the efforts of such engineers as Starling Burgess and Buckminster Fuller of Dymaxion fame among others, we will provide proper ratios between sprung and unsprung weight in all cars, and then the lighter cars will ride easier.

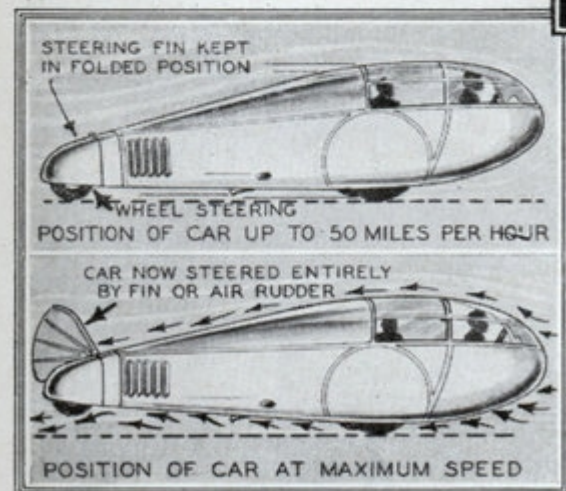
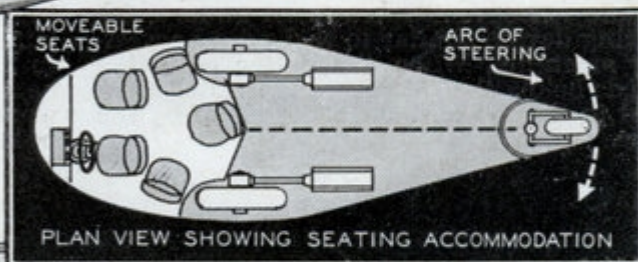


The car of tomorrow will make the parking problem look simple, as it will be able to draw into the curb in a space its own length with one maneuver, as this drawing illustrates.

Aerodynamically Efficient Cars Will Replace the Horseless Carriage-Type



Top silhouette shows reason why present day cars have reached maximum of development along standard lines. Center wash shows new Dymaxion proposed after lessons gained in trials of first car. Double motors, independently sprung wheels, tail fin steering are expected to give new motoring thrills. Right inset shows chummy seating possibilities.



Infinite wheelbase is gained with front wheel drive and the inverted V airkeel, which lifts the car and allows it to be steered by the retractable rudder shown at the rear. Tests of the original Dymaxion, in which 25% of the weight was on the rear wheel, failed in providing enough lift to elevate the wheel, but with minor shifting of weights this condition is expected to be fulfilled.

but an elaborated horseless carriage, brought to the perfection of its final limitations.

The ideas of Mr. Starling Burgess and Mr. Buckminster Fuller, two enterprising New York naval architects, as embodied in their unique Dymaxion, which underwent trials a couple of weeks ago, must in final analysis be proved by usage, but they are none the less interesting.

Mr. Burgess, a famed yacht designer, is also one of the earliest airplane engineers, having designed and flown the Burgess-Dunne tailless biplane years ago. His idea is unique in using rear wheel steering, allowing fine parking ability and ability to turn in the car's own length. And the Dymaxion is planned to have infinite wheel-base since the wind on her V-keel (inverted) is planned to lift the rear wheels off the road, allowing air rudder steering.

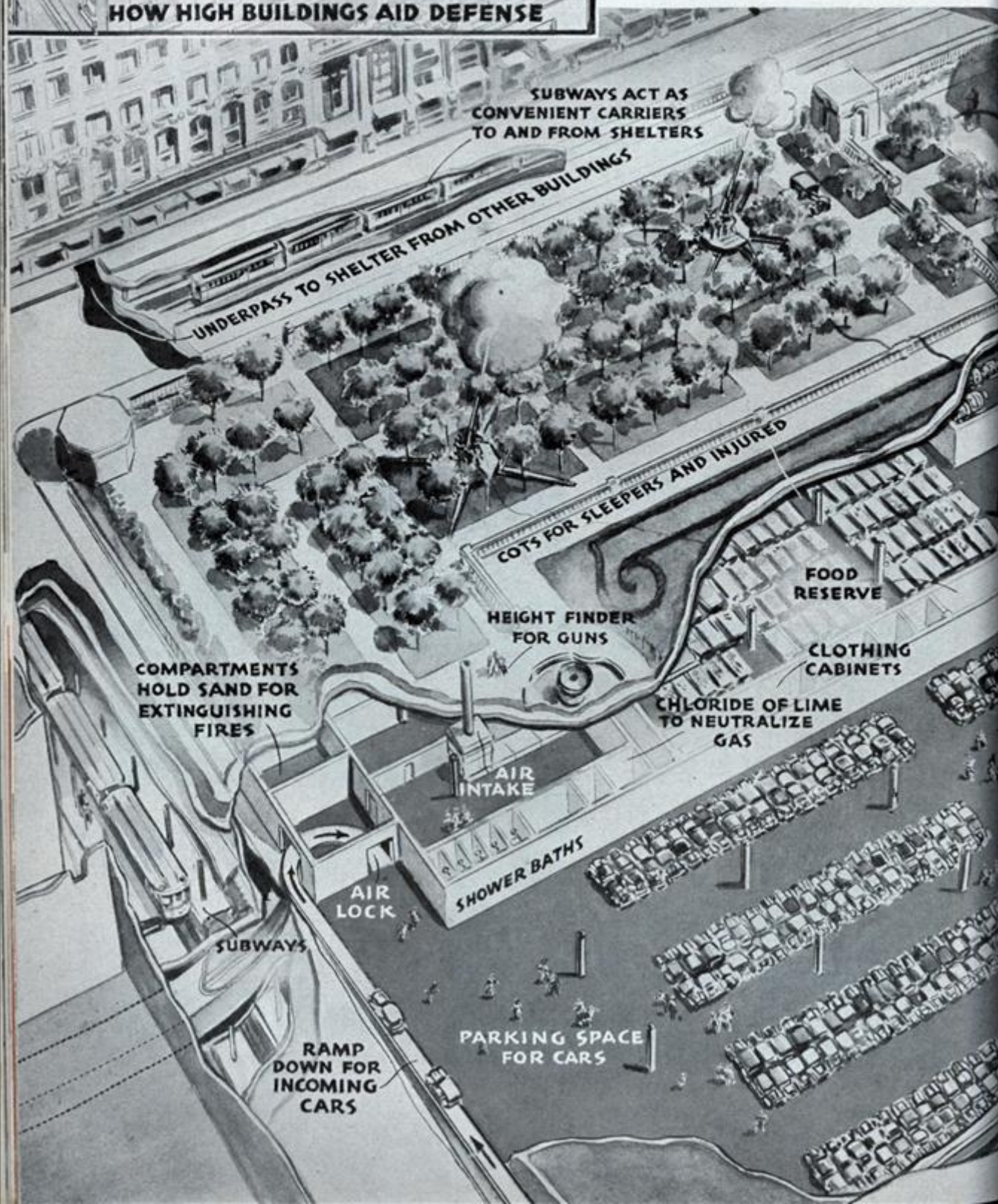
Stress analysis, aerodynamics are already being felt in automobile circles, and if my

(Continued on page 31)



bomb defense. The common demolition bomb of 550 pounds will penetrate a maximum of eight stories through a steel roof and steel and reinforced concrete floors. With the added protection of sandbags the penetration may be limited to three floors. The

Ely Jacques Kahn's plan for



most powerful explosive, upon hitting the street, will not hurl fragments able to penetrate modern walls higher than three stories. Poison gas cannot rise more than two or three floors above street level. Incendiaries, weighing only a few pounds, may not penetrate

a shelter under a city park

GREAT AIR-RAID SHELTER BENEATH PUBLIC PARK

RAMP UP FOR
DEPARTING CARS

AIR
INTAKE

LIGHTING AND
POWER PLANT

AIR
LOCK

AIR DUCTS

WATER SUPPLY

DIRECTOR FOR
ANTIAIRCRAFT BATTERY

ANTIAIRCRAFT
GUN

BOMBPROOF
CEILING OF
UNDERGROUND
SHELTER

6 FT. OF CONCRETE
3 FT. OF SAND
1 FT. OF CONCRETE

ABOVE-GROUND BOMB SHELTER

RAMP TO
UPPER FLOORS

HIGHEST LEVEL
REACHED BY
LETHAL GASES
IN AN ATTACK

PRE-CAST
CONCRETE SLABS

10 FT.

even through a modern building's roof. Even if they do, they must burn through almost completely fireproof floors and walls.

Refugees in a skyscraper, then, provided they remain three floors above the street and five or six floors below the roof, are safe from anything except a direct hit which may be directed at them slantwise. For bombs never fall straight; they strike whatever is in their path at an angle. Experience abroad, however, has shown that even a hit like this is a minor catastrophe. It will undoubtedly kill or wound persons sheltered at that level. Striking at the 25th floor, for example, it may penetrate diagonally down to the 20th, killing and maiming en route. But the building's steel frame is flexible; it will take the shock without collapsing.

No surface structure, modern or otherwise, can be made impervious to a direct hit except at terrific cost, and it is likely that skyscrapers will have to continue to take that risk. Important safeguards such as sandbagging on the top floors, placing sandbags between floors and windows to protect against flying fragments, and bracing windows or covering them with metal sheets, will add greatly to the general safety.

The skyscraper's defense rôle however is not limited to protection alone. Military experts concede that the heavily reinforced roofs would easily support anti-aircraft-gun emplacements, and shelters for gun crews.

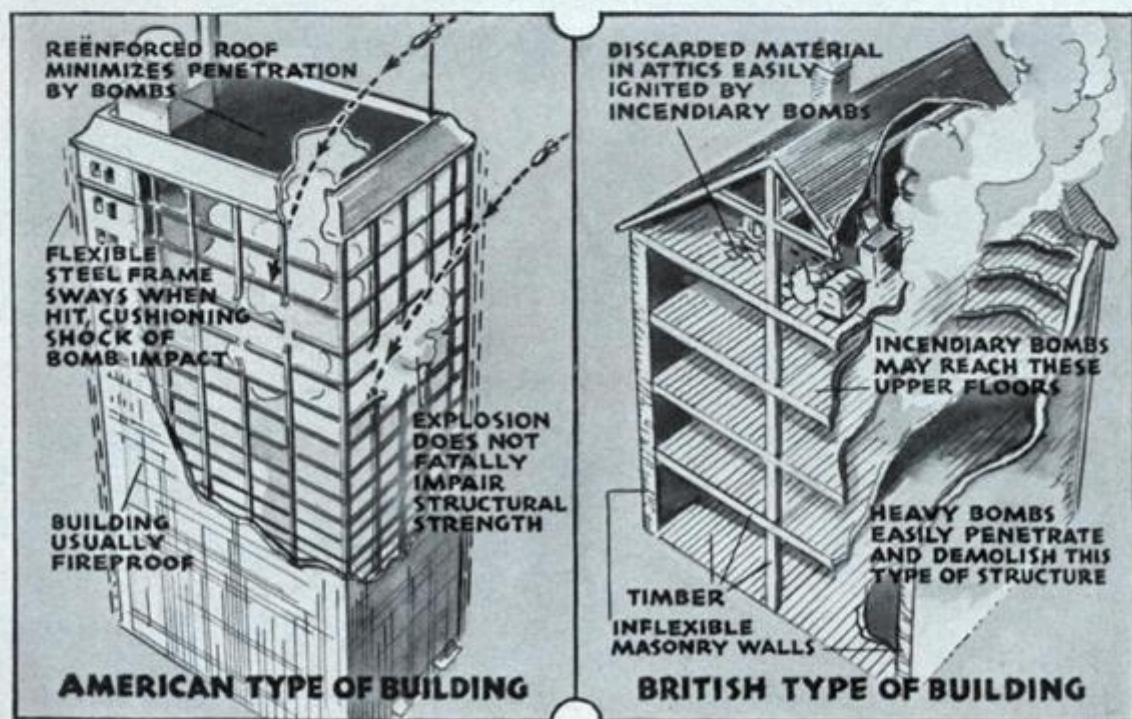
Unique and permanent underground shelters may be the solution in our cities' most crowded areas. In emergencies they may be

used as shelters for almost indefinite periods, completely equipped with food-storage, sanitary, and dormitory facilities; power units for lighting, heating, and ventilating; and ample ingress and egress motorways. A seven-foot layer of reinforced concrete, and reinforced concrete walls, would give them protection against demolition bombs.

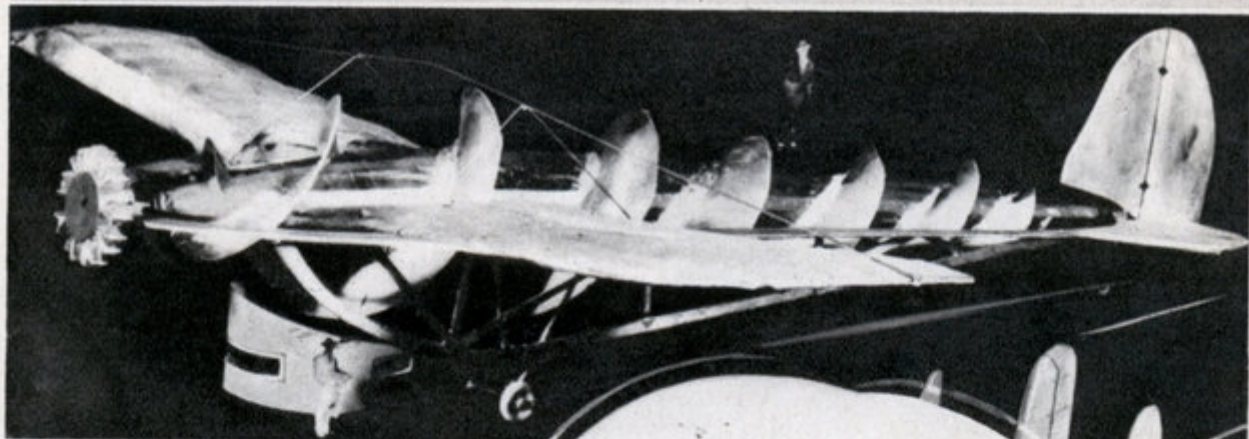
In time of peace these subterranean palaces, acres in area, may be transformed into useful civic projects. Thousands of automobiles may find storage and parking space there, new municipal markets, theaters, skating rinks, swimming pools, gymnasiums, auditoriums, and schools may be located there, far from dirt, noise, and traffic.

Ely Jacques Kahn together with his partner, Robert Allan Jacobs, has even envisaged these combination war-and-peace villages as the modern answer to the problem of slum clearance. Mr. Kahn is famous for the designing of many of New York's best-known buildings and department stores, such as the Squibb Building, 120 Wall Street, Bonwit Teller, Bergdorf-Goodman, and Jay Thorpe. Slums, he says, are peacetime hazards; they are worse in wartime. Raze them, therefore, and in their stead erect vast areas of parks, playgrounds, and apartment houses, with permanent shelters beneath them.

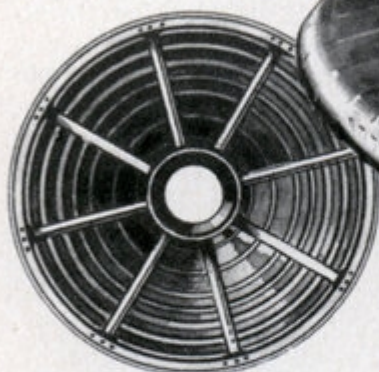
Bombs striking a building of structural steel and concrete do only local damage; less flexible structures are demolished



300 Mile-An-Hour Zep-Plane Proposed



Above—A model of the airplane-Zeppelin. Corkscrew vanes, driven by an airplane motor give 300 m.p.h. speed.

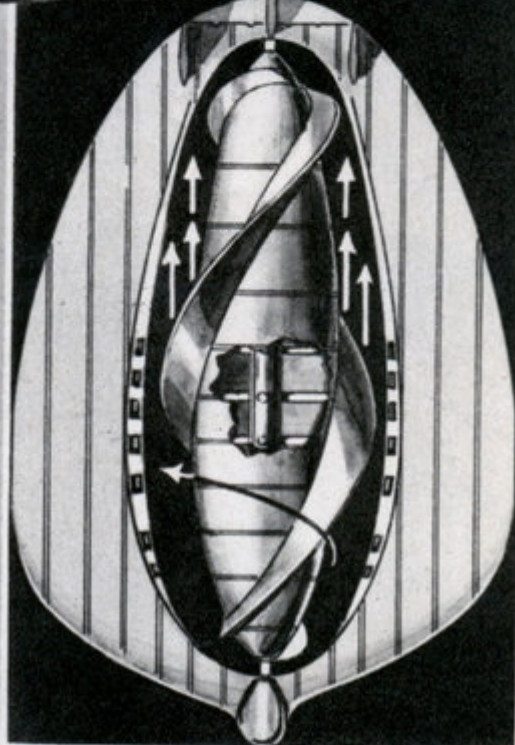


SECTION THRU HELIUM-FILLED ROTATING BERYLLIUM GAS BAG

CAPABLE of rifling its way through the air at a speed of 300 miles an hour, or hovering motionless above a chosen spot, an airplane-Zeppelin soon to be put through exhaustive tests at Rapid City, S. D., is expected by its inventors to become the transport plane of the future.

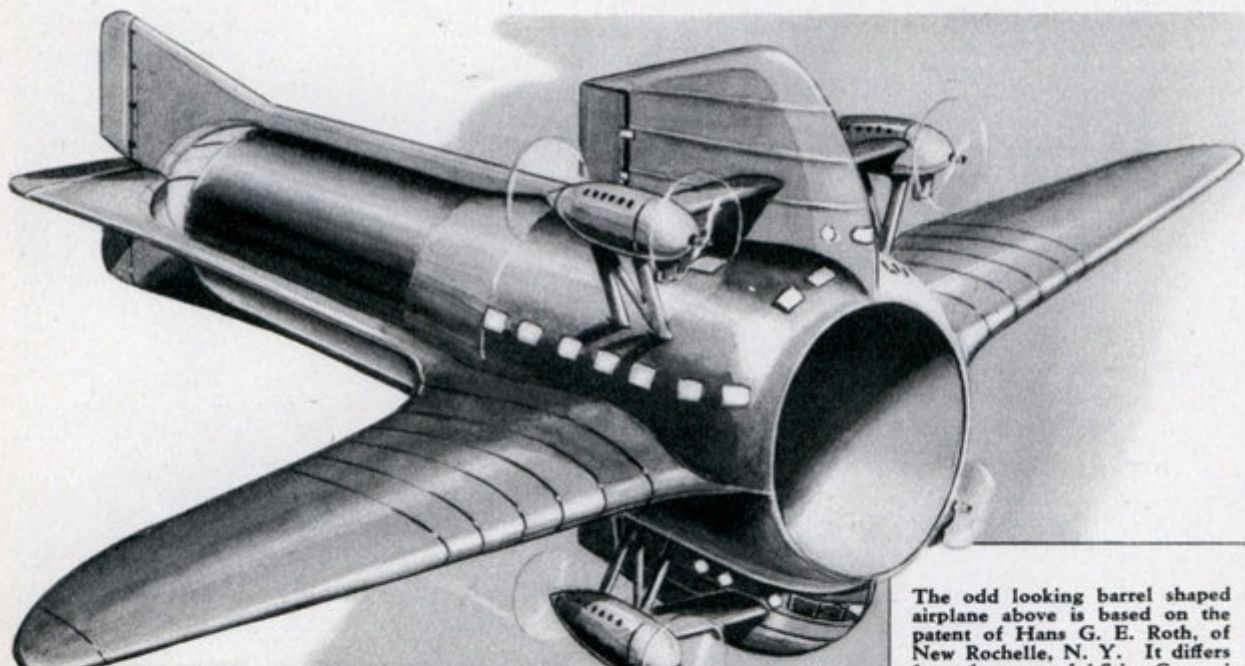
Startling though the design of the plane may be in its radical departure from accepted plans, combining as it does features of both the airplane and the Zeppelin, it represents years of work on the part of Rev. C. H. Loocke, known as the "Flying Parson," and Lorin Hansen, a young printer.

Suspended in a structure resembling a conventional airplane minus the fuselage is an all-metal, cigar-shaped gas chamber provided with corkscrew type driving vanes. This hull is built of beryllium and filled with helium gas to provide a large percentage of the lift.



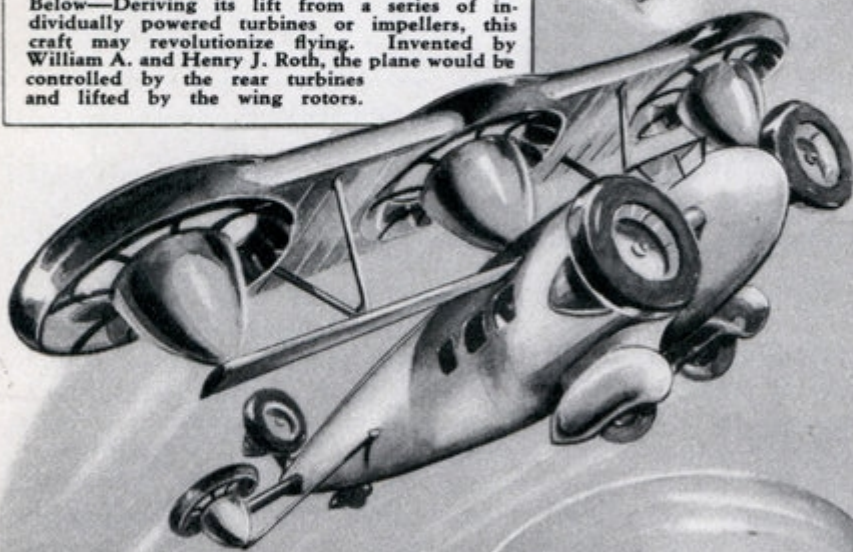
Artist's conception of the proposed 100-passenger Zep-plane and a diagram of operation are shown.

Inventors Patent Odd Designs

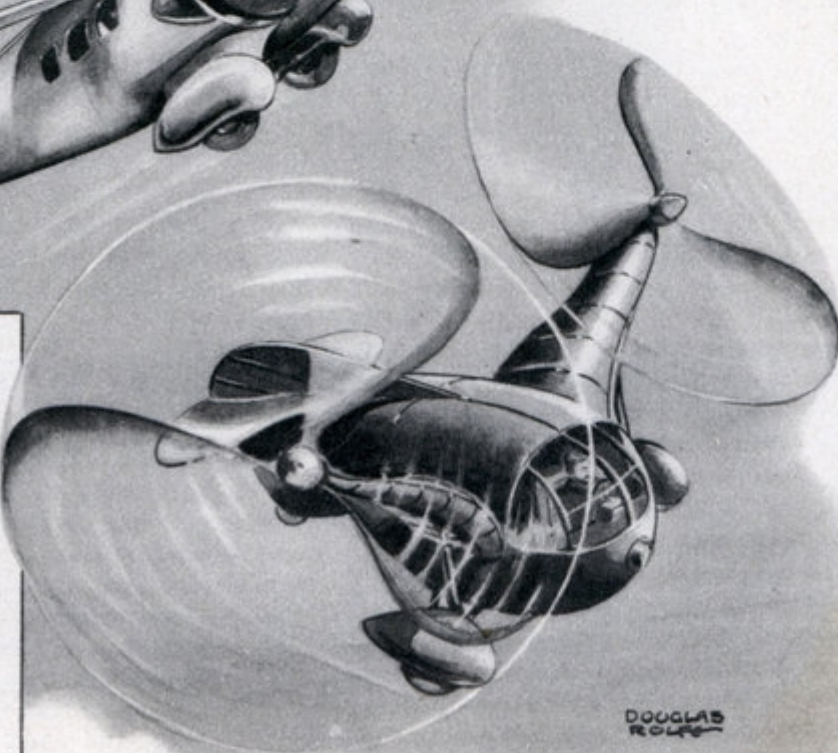


The odd looking barrel shaped airplane above is based on the patent of Hans G. E. Roth, of New Rochelle, N. Y. It differs from the successful Stipa-Caproni barrel shaped ship, built some time ago in Italy, in that the propellers are not mounted within the tunnel itself and in the curious arrangement of vertical fins above and below the main wing. These fins aid in lateral and directional control. Passenger accommodations would probably be located in the thickened portion of the barrel about the main wing, while the crew would be in the lower fin as shown above.

Below—Deriving its lift from a series of individually powered turbines or impellers, this craft may revolutionize flying. Invented by William A. and Henry J. Roth, the plane would be controlled by the rear turbines and lifted by the wing rotors.



The flying machine at right was patented by Russell S. Powell, of Takoma Park, Md. It is an attempt to solve the problem of direct lift without the use of wings to support the ship in the air. The two 3-bladed propellers are intended to provide both lift and forward movement. They are set normally at angles so that the force of the screws are directed downward and to the rear. Such an airplane would not require wings to lift it. While ships of this general type have proved they are able to exert sufficient lift, a means of maintaining stability has yet to be discovered. This is the difficulty Cierva battled for years before finally meeting spectacular success with his Autogiro.



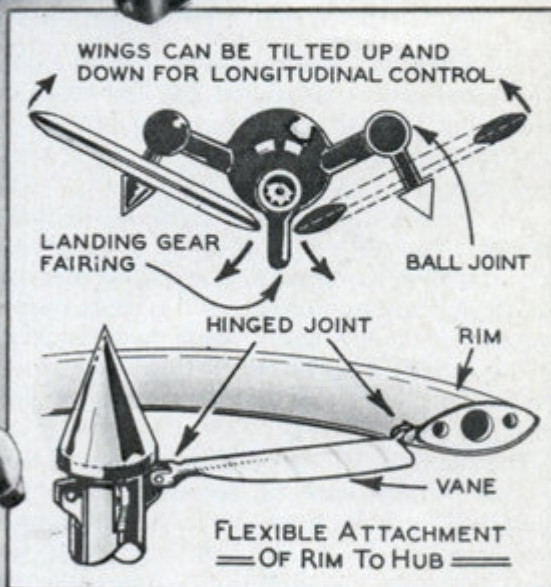
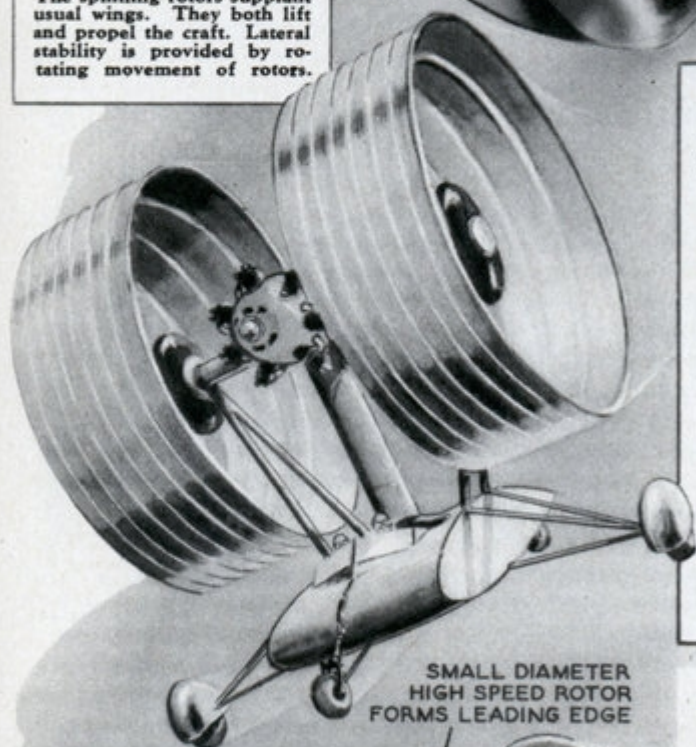
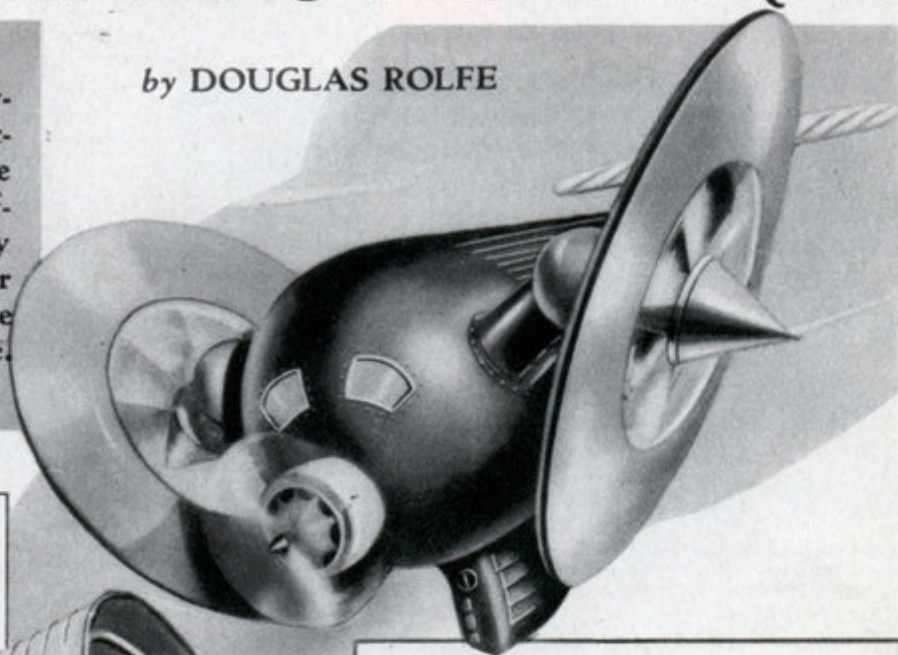
DOUGLAS
ROTH

FOR SAFER AIRPLANES

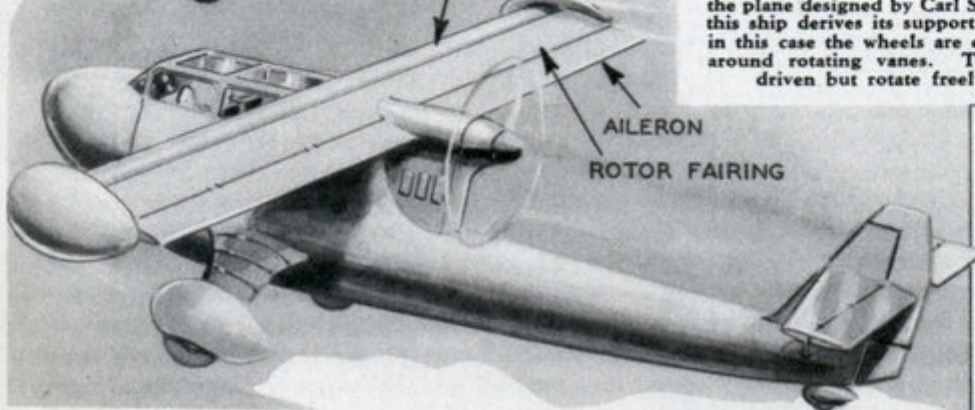
by DOUGLAS ROLFE

Unusual ships, straying away from accepted designs, are being tried in an effort to increase safety and simplify air travel. Some of the ideas are shown here.

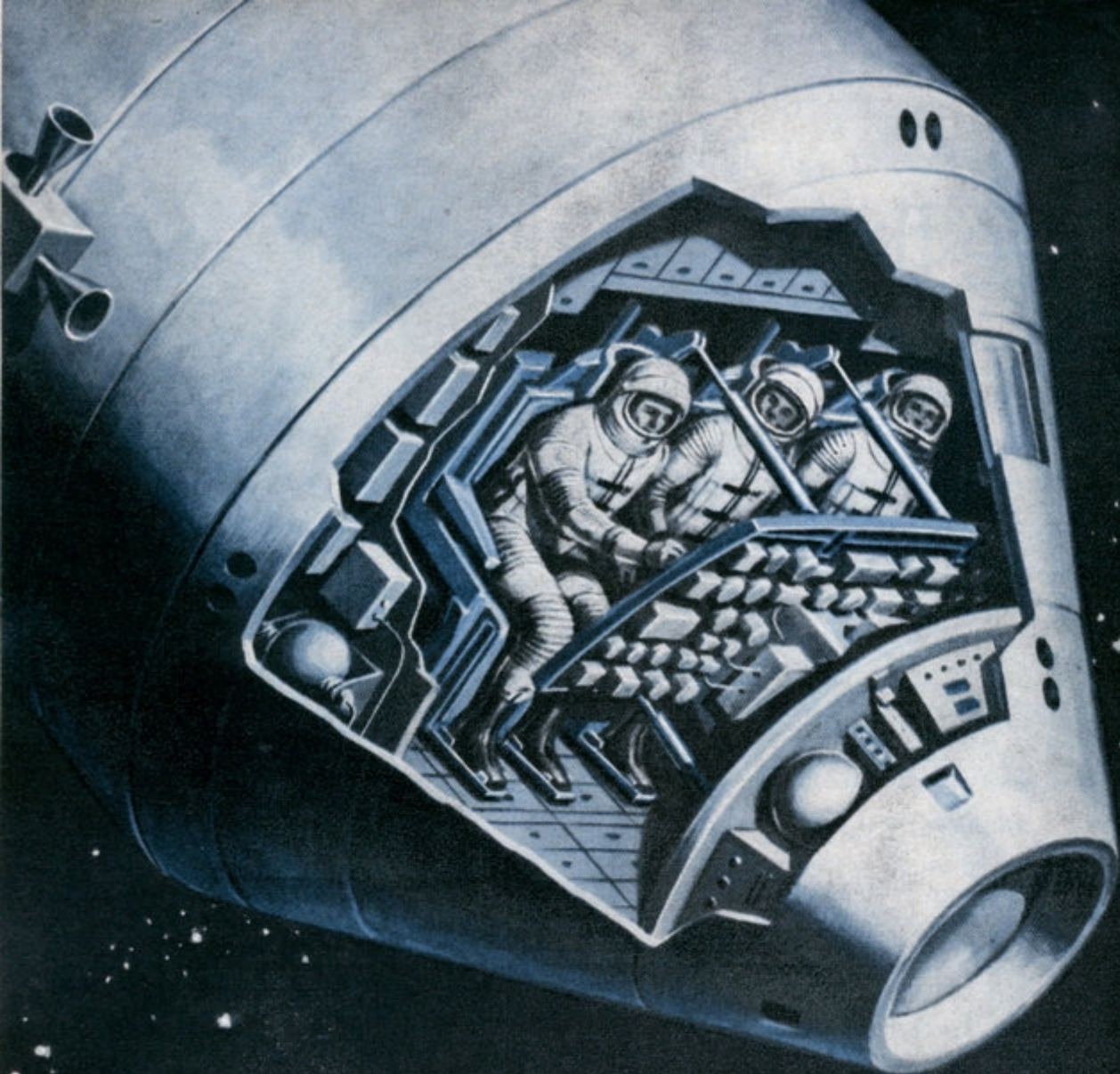
The remarkable "side-wheeler" below has actually undergone tests in France. The spinning rotors supplant usual wings. They both lift and propel the craft. Lateral stability is provided by rotating movement of rotors.



The "Spinning Top" plane, illustrated in the drawings above, is the latest idea for the application of the paddle wheel theory now being tested abroad. Like the plane designed by Carl Strandgren (at left above), this ship derives its support from rotating wheels but in this case the wheels are composed of an outer rim around rotating vanes. The vanes are not power driven but rotate freely as in the autogiro.



The ship at left, designed by Alexander Chessin and Serge Trey, is intended to improve safe flying. A 12-inch hollow cylinder, 23 feet long forms the leading edge of the wing. Built on the Flettner rotor principle, it rotates 7,000 r.p.m. A constant stream of air is directed onto the cylinder by tiny jets to insure continuous lift.

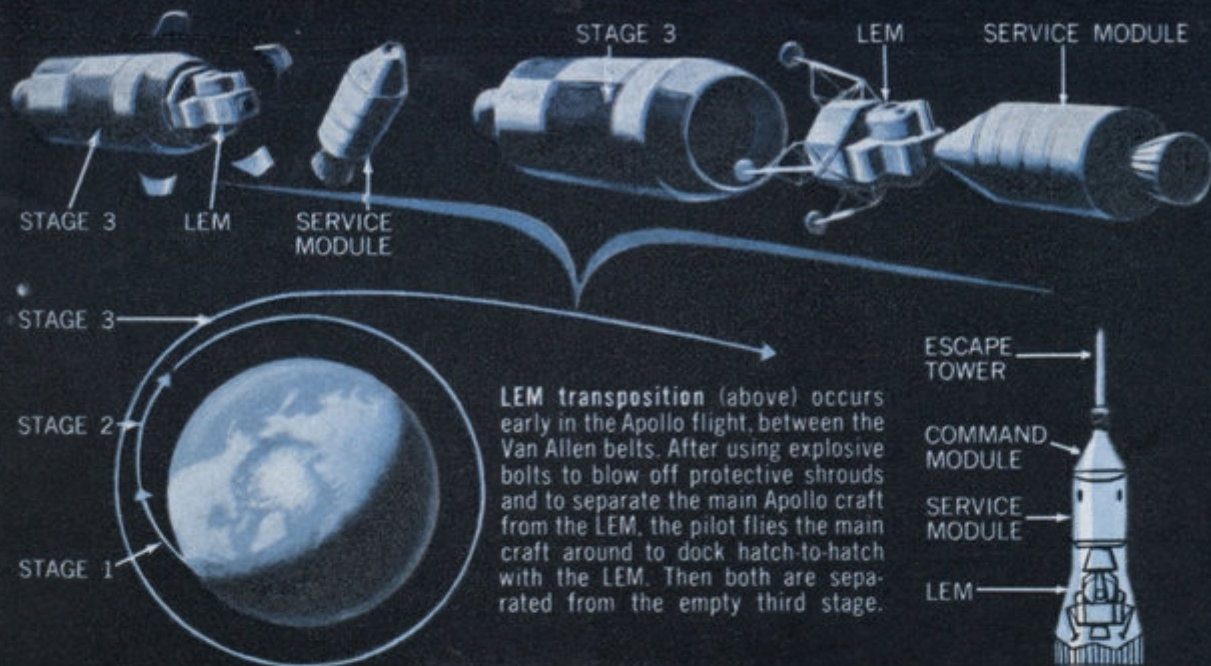


MAN TO THE MOON

What will that first trip be like when—soon—
brave men soar into the skies to conquer the moon?
Here is a preview of that great adventure

By Tom Alexander Author of *Project Apollo: Man to the Moon* (Harper and Row, New York)

Illustrations by Ray Pioch



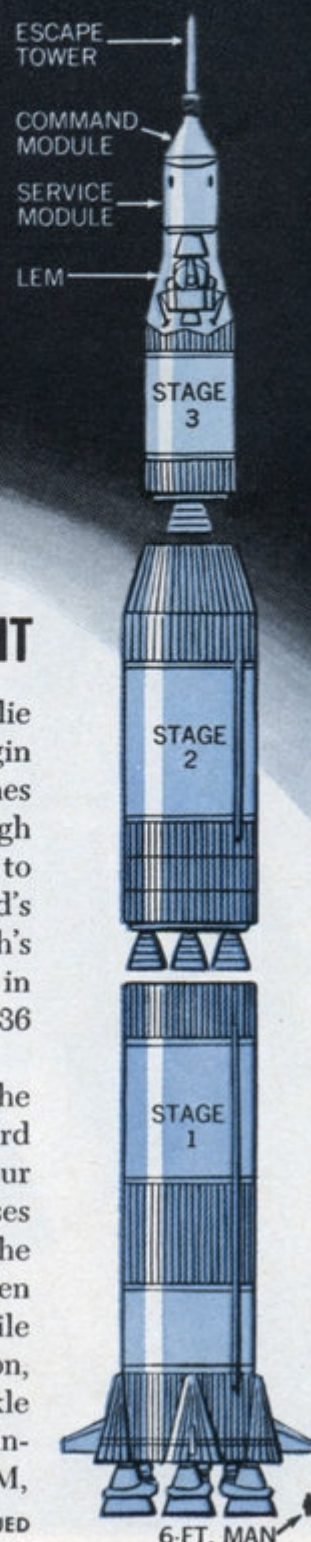
LEM transposition (above) occurs early in the Apollo flight, between the Van Allen belts. After using explosive bolts to blow off protective shrouds and to separate the main Apollo craft from the LEM, the pilot flies the main craft around to dock hatch-to-hatch with the LEM. Then both are separated from the empty third stage.

THE FLIGHT

Atop their vast and audibly seething assembly, three men lie breathing quick in concentration as earth and rocket begin to cast off lines. In the last second a hundred switches clatter, fires are kindled, valves open, flames belch and cough smokily. Long, slow vibrations run upward through the rocket to jostle the crew, then begin smoothing away as the launch pad's hold-down clamps fall. The Saturn poises, struggling against earth's gravity and an atmosphere clinging like glue to its sides. It rises in a thunderous stroke to stage-one burnout at 150 seconds and 36 miles. . . .

The million-pound thrust of the second stage cuts in to spiral the astronauts outward toward their parking orbit, where the third stage burns briefly, circularizing their elliptical path. For an hour and a half the craft drifts around its orbit. The computer muses on radar data coming up from earth and resets verity into the inertial-guidance system, whose delicate sense of direction has been a little addled by the stresses of the last few minutes. Finally, while the craft passes over that side of earth most distant from the moon, the third stage fires once more. Their radiation counters crackle warningly as they soar into the inner Van Allen belt, then diminish. They have 30 minutes between the belts to tend to the LEM, to fit it tip-to-tip to the Apollo capsule.

CONTINUED

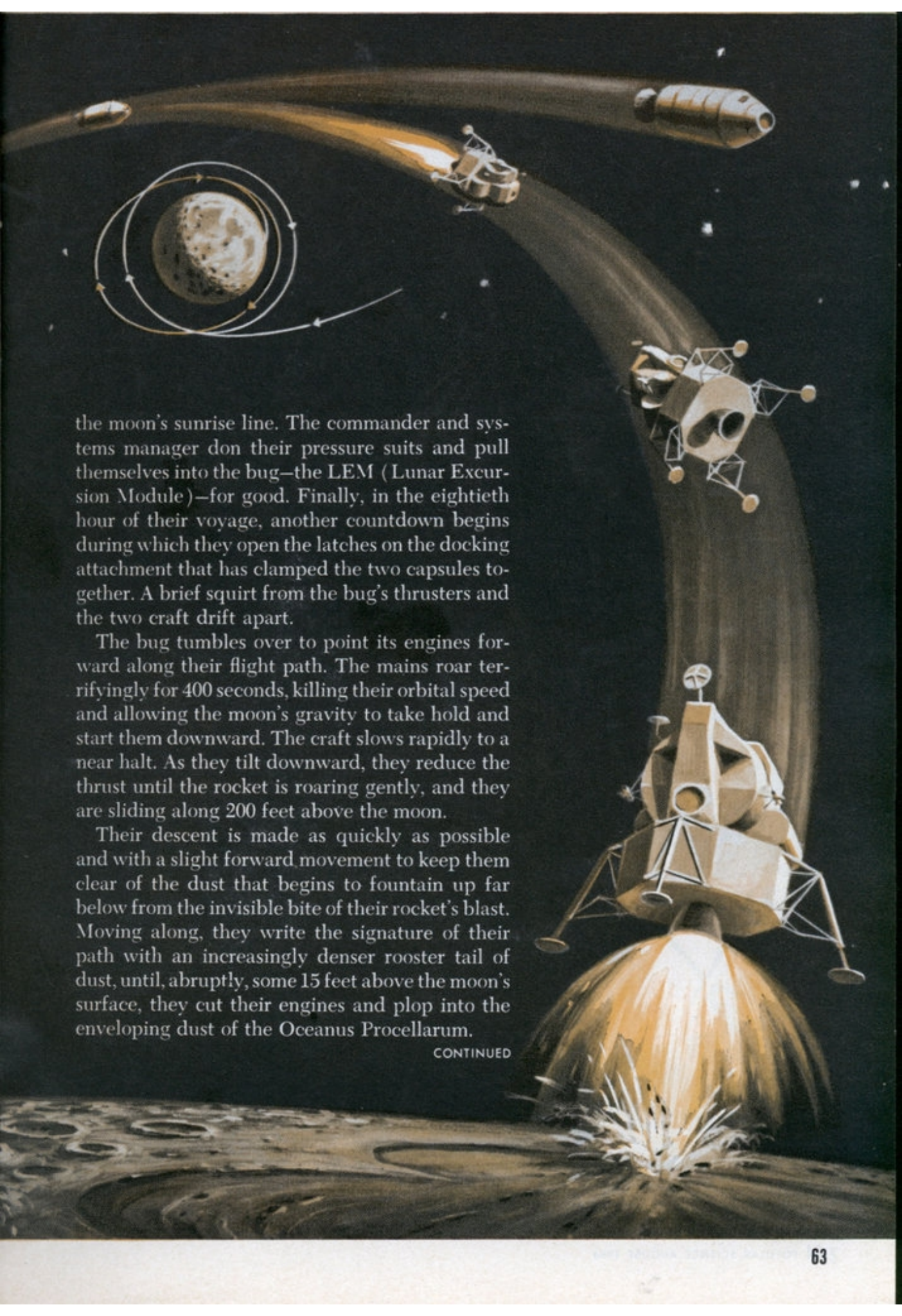




LANDING ON THE MOON

Faint, steady noises accompany them: the whir of gyros, a tiny hum of inverters converting fuel-cell electricity into alternating current, a hiss of air in the pilot's spacesuit. Periodically, a pump whines, a valve or relay clucks to itself, a control jet moans. Every few minutes, earth breaks in on the loudspeaker with a message, a query, or a time check—but already earth is only a mildly interesting "they" and the astronauts are "we."

They cross past the moon's dark western limb and brake into an orbit girdling the lunar equator. After long minutes of drifting through the darkness beside the moon, cut off from contact with the earth, the spacemen come in sight of the sun again, and shortly cross the terminator—

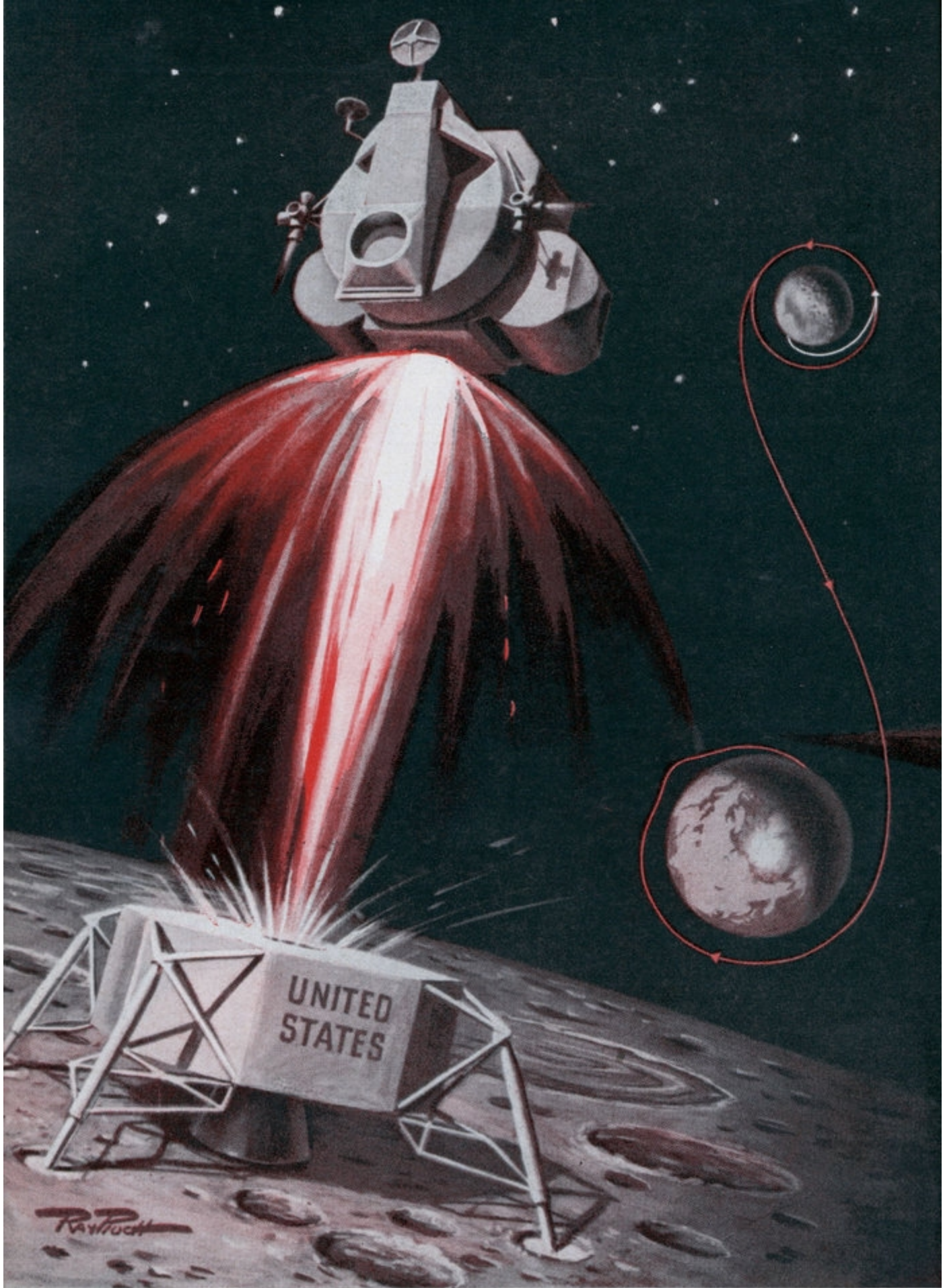


the moon's sunrise line. The commander and systems manager don their pressure suits and pull themselves into the bug—the LEM (Lunar Excursion Module)—for good. Finally, in the eightieth hour of their voyage, another countdown begins during which they open the latches on the docking attachment that has clamped the two capsules together. A brief squirt from the bug's thrusters and the two craft drift apart.

The bug tumbles over to point its engines forward along their flight path. The mains roar terrifyingly for 400 seconds, killing their orbital speed and allowing the moon's gravity to take hold and start them downward. The craft slows rapidly to a near halt. As they tilt downward, they reduce the thrust until the rocket is roaring gently, and they are sliding along 200 feet above the moon.

Their descent is made as quickly as possible and with a slight forward movement to keep them clear of the dust that begins to fountain up far below from the invisible bite of their rocket's blast. Moving along, they write the signature of their path with an increasingly denser rooster tail of dust, until, abruptly, some 15 feet above the moon's surface, they cut their engines and plop into the enveloping dust of the Oceanus Procellarum.

CONTINUED



THE RETURN FLIGHT

The returning explorer sticks his head in through the bug's snoutlike front hatch. He places the last labeled bag of geological samples and the photographic film on the cockpit floor and finishes hoisting himself in.

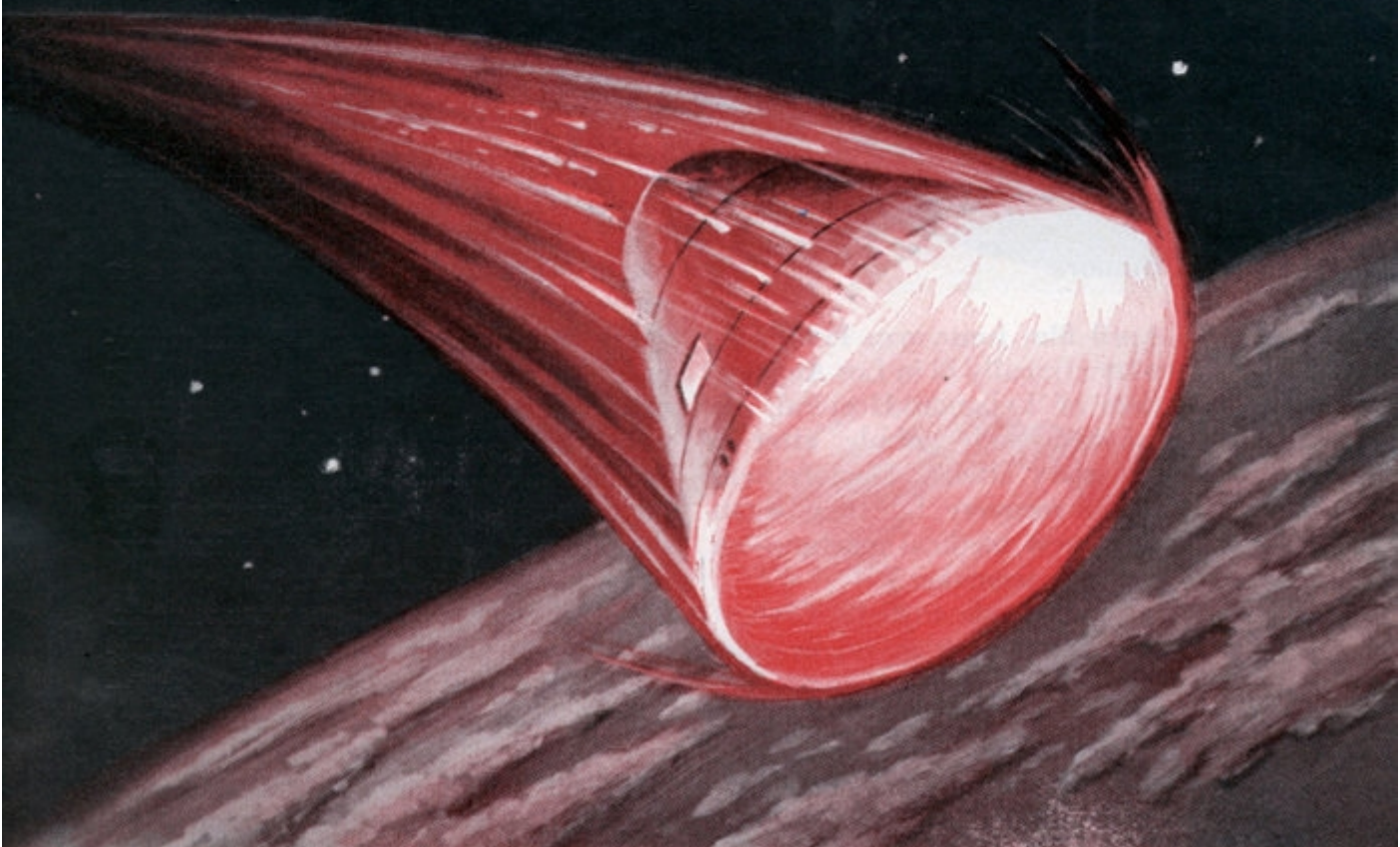
The crew grinds through its last check-out. Now, exactly on schedule, the whine of the mother ship's radio beacon comes up over the low hills to the east. As the bug climbs within three degrees of the zenith, its takeoff rocket blasts ostentatiously as it parcels out precious velocity toward careful ends. The lunar scene disappears behind a curtain of dust and fire, and the bobtailed remnant of the bug rises off its spider-legged pedestal—a pedestal whose descendants could become as commonplace on celestial bodies touched by man as his 55-gallon drums have become in all the distant corners of the earth.

Whirring downward from the moon,

systems ticking through the 80 hours of cislunar space, Apollo winds out the final movements of the clockwork that was set in motion the instant it left earth a week before.

The plan is for the craft to enter the atmosphere 400,000 feet above the Pacific, skidding on its bottom, to plunge in and briefly sample the maximum of 10 Gs and 500 degrees permitted, then to skip out to the cool of space and weightlessness before making the final plunge. In the course of that plunge, Apollo's skin will be seared, charred, and melted, and it will emerge looking like a burned popover.

Hopefully, at the right moment the slowed and sizzling capsule will tumble into the skies over the United States. At somewhere around 15,000 feet, like a whipped-cream topping, first a stabilizing drogue chute and then the three main, slow-opening parachutes will bloom. Billowing parachutes are the happiest sight of all in the astronaut trade. ■ ■

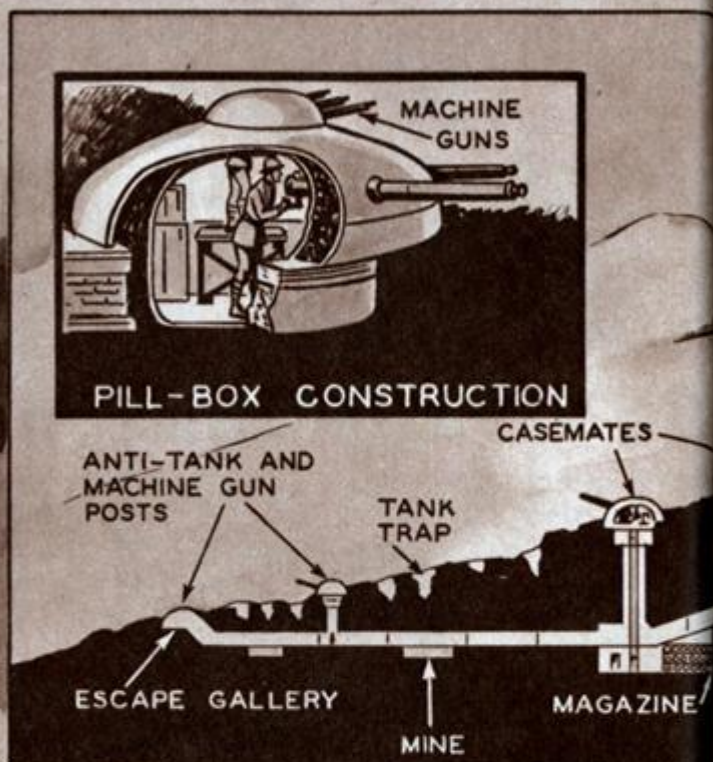




CAN THIS WAR

Modern fortifications along the Maginot and Siegfried lines have made France and Germany "invasion proof." The result may be a war no nation can win!

by
Maxwell Hamilton



WHAT happens when an irresistible force meets an immovable object?

This age-old problem in physics, a familiar question to every school boy, seems destined to find an answer in Europe's latest armed conflict. For the present "war to end wars" is a contest between two of the world's greatest immovable objects—the Siegfried and the Maginot lines!

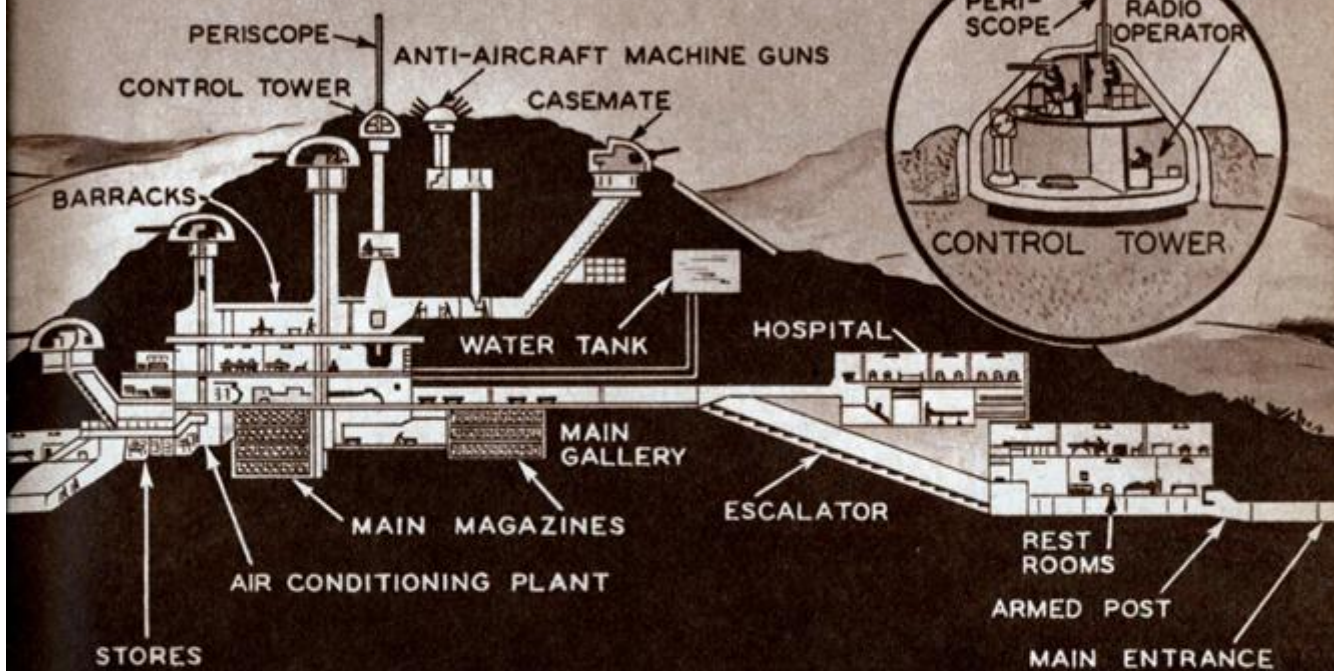
Imagine, if you can, an advancing horde of 2,000,000 men. It is armed to the eyes with



BE WON?

Above is a comprehensive cross-section sketch of the famous Maginot line, showing the traps which are waiting for an attacking foe. Below is the inside of a typical sector of the line, showing the subterranean passages, barracks, and ammunition magazines. A huge army lives underground as France waits a German attack.

MAGINOT CROSS-SECTION

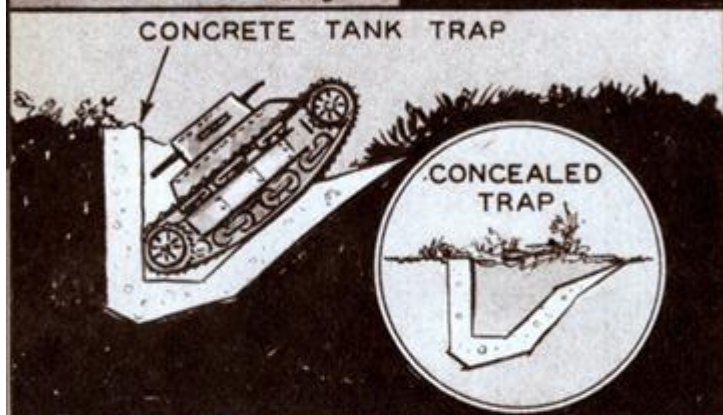


Right: French troops passing through a tunnel of the Maginot line, more than 100 feet below the surface.

high-speed, rapid-firing tanks, motorized cavalry and infantry, mobile artillery and ammunition units, every known type of poison gas, and the most modern and efficient equipment available for pouring forth a ceaseless storm of shot and shell, endless tons of lead, steel and flame. Magnify this glittering array of death on the march five times over—and, against it, the French defenses on the Maginot line still would remain impregnable!

On the other hand, should the Allies abandon such snug security and launch an attack of their own, just as much power and strength and cunning, multiplied many times over, would avail them nothing. The German Siegfried line—not 10 miles away—is just as redoubtable, just as impossible





The drawings above show the methods used to foil the advance of oncoming tanks—iron rails driven into the ground, and cleverly concealed pits into which tanks fall and are rendered useless. Upper right: A French fort, part of the Maginot Line. Below is an underground power room, which generates electricity for the Line.

to penetrate, as the French fortifications.

It is Armageddon, giant against giant, with victory in the lap of the gods.

Of the two great bulwarks, the French Maginot line would seem to have whatever slight advantage exists. Begun 10 years ago, it has cost France \$300,000,000 and has taken all of the intervening years to complete. It is modern, it is thorough, it is highly scientific. The German counterpart, on the other hand, is a product of feverish building over the short space of the last year and a half, with the natural weaknesses of hasty construction deemed certain to appear under fire.

It is to the late Andre Maginot, ex-War Minister of the French Republic and veteran of the First World War, that credit for these amazing fortresses must go. Lying wounded and despairing in a 1917 base hospital, Maginot, a sergeant of artillery, stared at the

bullet-pocked ceiling above him, gritted his teeth and groaned with pain.

"I hate war," he muttered. "I abhor it."

Eighteen years later, in a meeting of France's Supreme Council of National Defense, Maginot, the new war minister, 6 feet 2 inches of man, rose to his feet, outlined on a map the French border from Luxemburg to Switzerland and stated his position coldly and determinedly.

"We must build a wall along here," he said, "that the devil himself can't break through!"

The result: the Maginot and, later, the Siegfried line.

In a time of peace, you might cross and re-cross the Maginot fortifications and see nothing but rolling hills, dense thickets and an occasional peasant's shelter. If you were particularly observant, you might note a scattering of small, dome-shaped mounds

protruding from the earth, mounds which—in any other locality—would certainly be taken for underground reservoirs or drainage tanks.

Far from drainage tanks, these mounds mark almost the only visible evidence of the greatest fortifications in the history of France! These are pill-boxes, heavily armed, constantly manned—and facing east. What looked like an ordinary thicket turns out to be an enormous cruel mass of twisted barbed wire, and what might have been taken for a peasant's shelter is, in reality, a block-house, with walls 60 inches of cement and steel and blended into the color of the hillside.

The Maginot defenses really comprise three parts.

The first consists of the pill-boxes—the dome-shaped mounds—built along the base of the hillside. Although connected with the other fortifications by underground passages, each pill-box is a separate unit, isolated, to be sold out to the invader at the highest price. It is manned with the very latest type machine guns that can fire for 24 hours without a stop. It has sanitary facilities and is stocked with ammunition, food and water; for it is its purpose to impede the enemy, discourage his advance and then surrender only when its occupants are dead. For volunteer "suicide squads" will man these outposts.

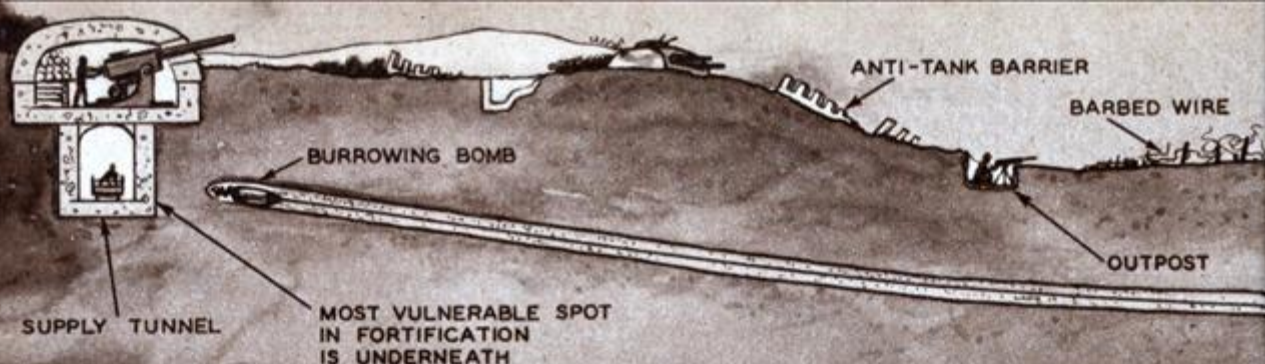
Behind the pill-boxes are the block-houses, containing machine and field guns and connected with each other, and the rear, by subterranean tunnels. They, too, are independent units, capable of standing on their own and—when pill-boxes have fallen—of setting off mines in the passages between these units in order to cut off access through that quarter. The third part of the line also consists of block-houses, only this time they contain more powerful defenses—75 and 155 millimeter cannon (3- and 6-inch)—radio stations, observation posts, field headquarters, and so on.

But these are but surface manifestations of the great Maginot defenses, and, like an iceberg, France's newest forts are $\frac{7}{8}$ ths under the surface. Behind the three front lines, and deep in the bowels of the earth, are the living quarters and administration divisions of the defenders. Thus, as fast as front line troops grow weary, fresh detachments are ready and



Left: A mountain dugout on Germany's Siegfried Line, not far from France's Maginot fortifications. The two photographs below show how Germany expects to keep the giant French tanks at bay. The one at the left shows a line of concrete tank traps, while the one directly below shows a double barricade of crossed angle irons.





On these pages our artist has drawn a "Burrowing Bomb," which might answer the invulnerability claims of both the Germans and the French as to their defenses. This mechanical "mole" would carry an explosive charge and be directed through a control cable by men in the dugout from which it was started on its way. How it would operate is shown in the upper sketch. At the right are shown close-up drawings of the "mole." Could Hitler have had such a device in mind when he uttered his threats of "weapons known only to Germany?"

able to go into service. And should the enemy penetrate the three outer walls, he is met back of the lines by brigade after brigade of well-equipped fighters who pour out of the cavernous reaches of the underworld from all sides.

Within the heart of the hillsides, an army can live for months in the ingenious recesses of which Andre Maginot dreamed. There are comfortable steel-lined barracks, air-conditioned and strengthened to withstand five times the assault put upon them in their first tests. There are escalators from one level to another, kitchens, hospitals, ammunition dumps, reservoirs—even wine cellars and recreation rooms. Telephone cables are steel-insulated to withstand the shock of high explosive, and when they fail there is the radio. If that goes dead, then pigeons go into action.

The fact that the superstructures are located on hilltops minimizes the poison gas nuisance. Gas needs dry weather and low, windless country; but, even if it came, the Maginot line would be ready for it. Guns are set in water-tight jackets and embrasures that defy the entry of gas; and the smoke and fumes from gun discharges within the fortifications are ingeniously disposed of through ducts which permit exit but not entrance. The air in these defenses, aided by pressure, is as pure as that of a mountain cave.

As safe as they are inside, the inhabitants of both the Maginot and Siegfried lines are amply protected on the surface. Andre Maginot, as well as his rivals across the German border, realized that such defenses might be surmounted or crushed easily by the fast and powerful tanks of the war that was to come, and this angle has been taken into consideration.

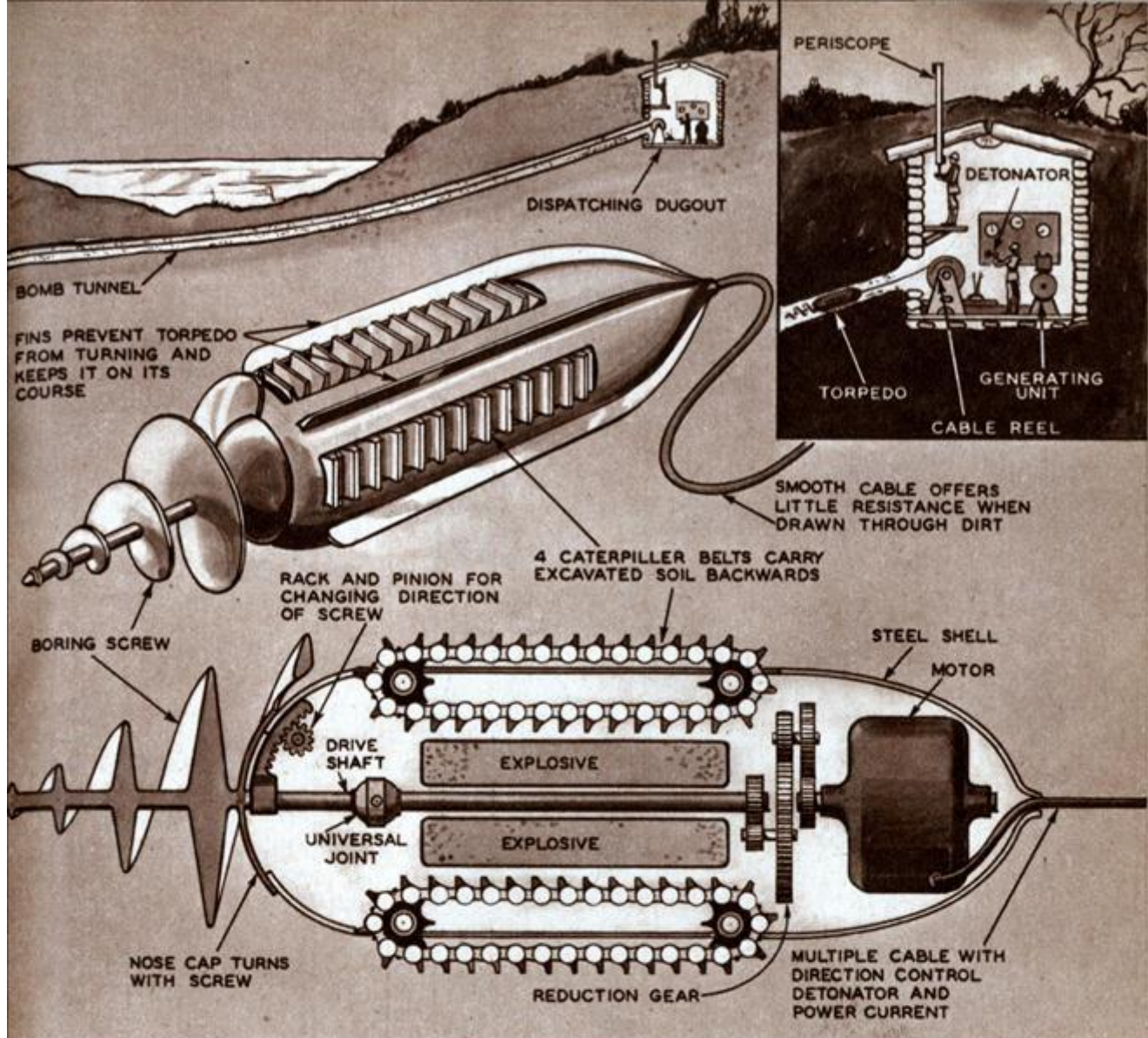
Machine gun nests, block-houses and other

defensive works are skirted by a veritable morass of tank traps. Thousands of steel rails, set end upright in solid concrete and steel, and with their upper ends protruding at different heights out of the earth, stand like a garden of irregular bean poles to impale the fastest tank and strip its belt tracks. If an enemy driver successfully skirts this "asparagus," and is not disabled by the withering anti-tank cross-fire which besets him from pill-boxes and block-houses on all sides, his troubles have just begun. For he will find that the most solid earth will turn out to be a deep, wedged-shaped pit, concealed by grass and underbrush, and into which he will sink out of action.

In the meantime, the infantry is having its troubles in jungles of barbed-wire, carefully woven and supported in days of peace, when things can be done carefully and devilishly. In some instances, these nests of wire are even electrified to put the crusher on any army that dared to try to pass or cut them.

In this latter respect, the German and French defenses are much the same and present no dissimilarity to the casual observer. The German "asparagus" protrusions are different only in that the rails have been encased in concrete and stretch in columns of four for miles and miles along the border. They were built by Fritz Todt, German road expert, who drove an army of 500,000 workers for more than a year before completing the project last Summer.

With this minor difference, and despite the denials of Adolf Hitler, the German West Wall—as the Siegfried line is called in the Reich—is almost a copy of the Maginot fortifications. There are reputed to be almost 600 of the hillside, pill-box forts of the Maginot type on German soil, all complete with living quarters, air conditioning, latest



type armaments, plumbing, telephones, radio and recreation facilities.

The German barricades extend more than 400 miles along the frontier, are drilled—in some places—as much as 30 miles into German territory, and are said by Der Feuhrer to be able to withstand any attack, whether from air, by tank, by gas or heavy artillery.

The British have deprecated the efficiency of the German line on several occasions. According to their reports, the subterranean dug-outs of the Germans may be able to thwart any human enemy but were flooded by the high waters of the Rhine last Summer, forcing a hasty evacuation. Furthermore, they say, the German soldiers are unhappy underground because of the fact that the galleries are crammed to overcrowding with ammunition, the air conditioning doesn't work and ventilation is bad, and there has been a marked shortage of food, forcing the

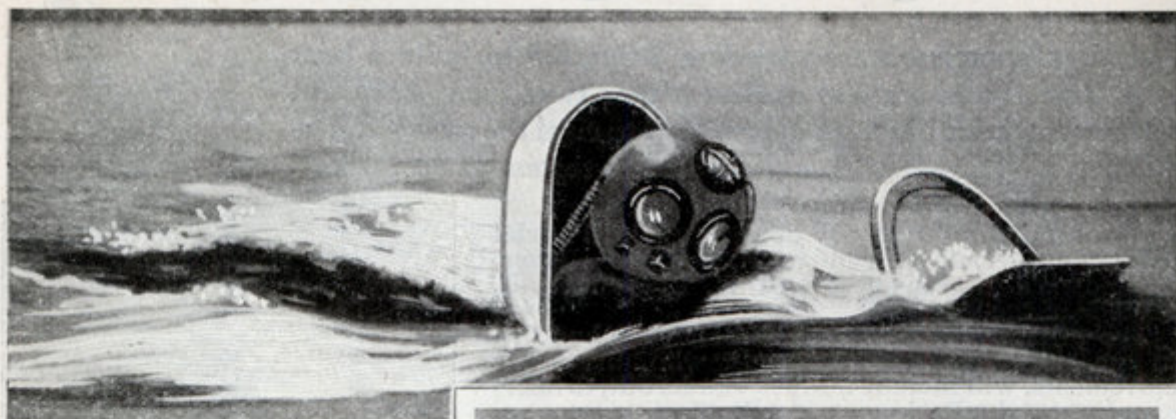
troops to come out and show their hideaways.

Regardless of these rumors, however, it is apparent that both teams have power aplenty to stave off attack from all sides, and neutral observers are of the opinion that this new war really may be *the war to end wars*. They point out that, with neither side able to gain any ground on the other, they will have to resort to air raids and bombing of non-combatants, and eventually—like invincible knights of King Arthur—both sides will battle to exhaustion. And the conflict will be at an end.

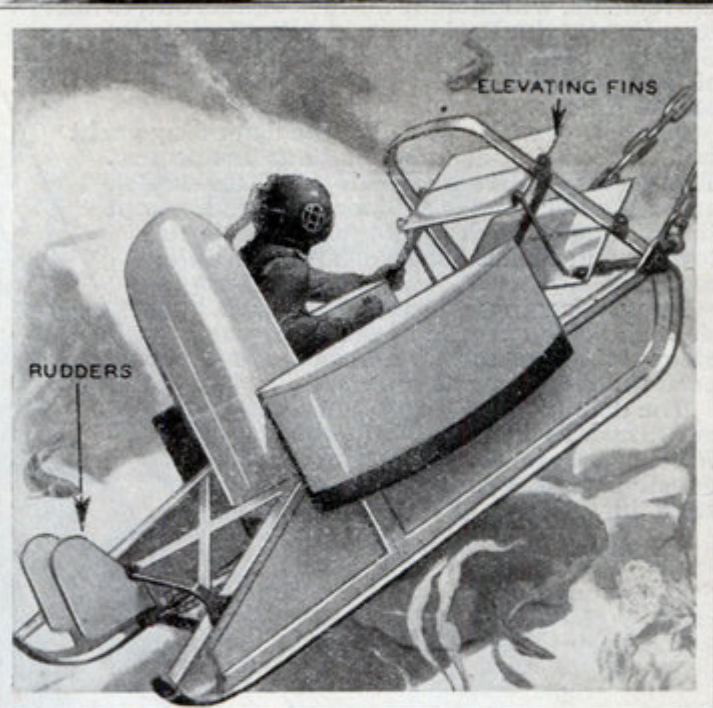
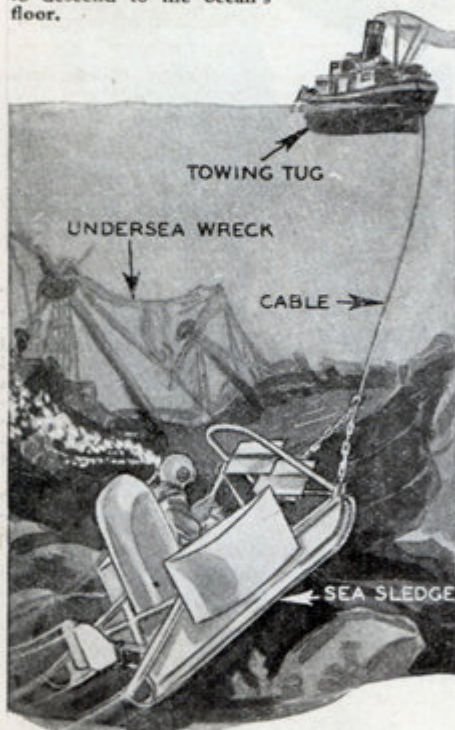
But man's best laid plans sometimes go awry. Both Germany and the Allies are rumored to have some secret and amazing weapons which they are saving till the real scrap begins. If these rumors are true, then guesswork goes out the window.

The question is, however—Have the boys got such weapons?

Undersea Sledge HUNTS Sunken GOLD



This photograph shows the treasure hunting diving sled as it is being towed and about to descend to the ocean's floor.



The artist's drawing illustrates the manner in which the diving sled travels along the floor of the sea. At left is another drawing showing the entire operation of this novel and efficient method of hunting sunken treasure ships.

THE tedious and dangerous task of searching the ocean's bottom for sunken ships laden with treasures is simplified by a diving sled perfected in Germany.

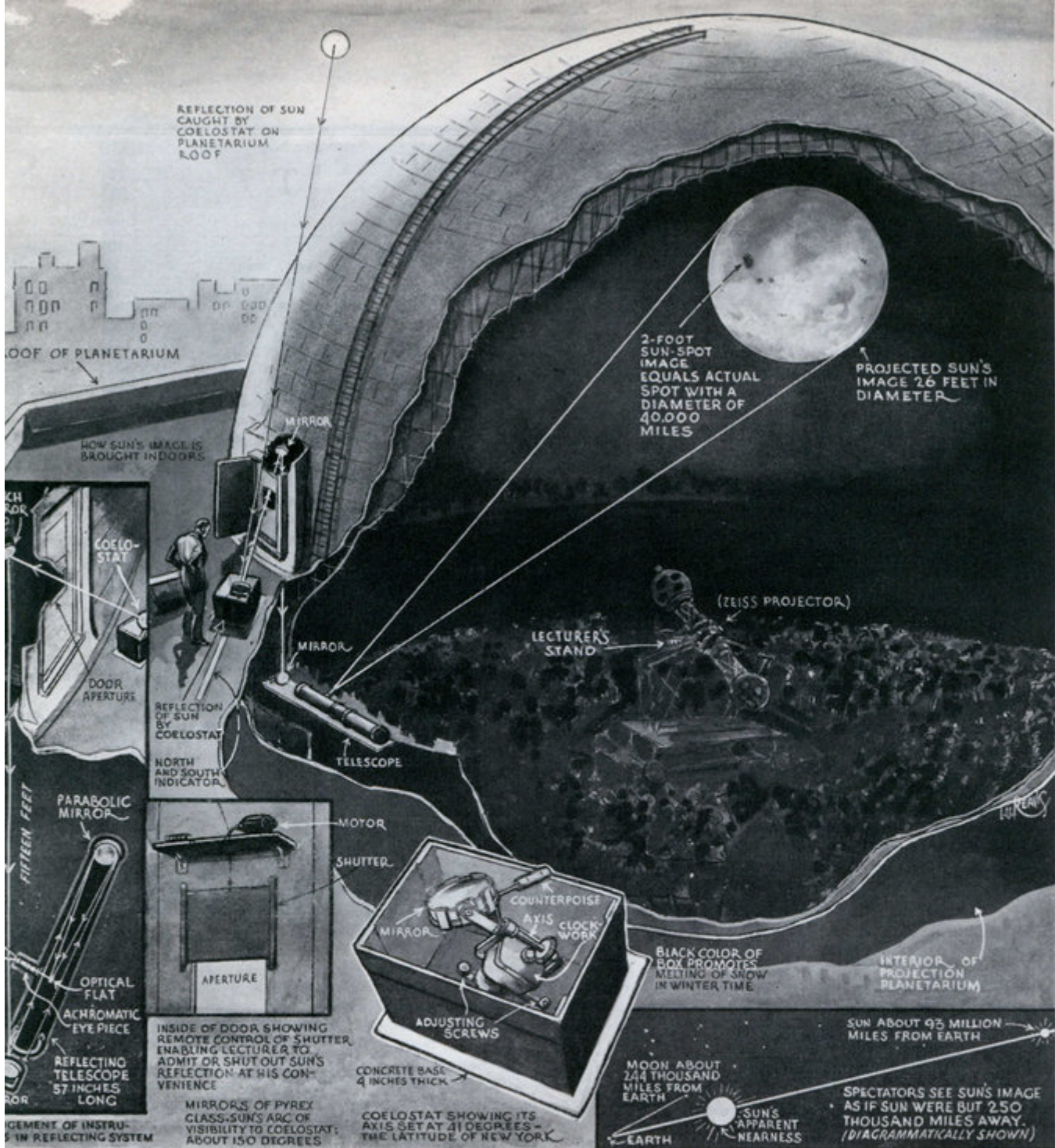
The floor of the ocean is literally strewn with ships which went down, taking with them to Davy Jones' locker hundreds of millions of dollars in gold.

The heavy weights which a diver must carry in his boots to counteract the weight of his helmet and the buoyancy of his air-filled garment, make it extremely difficult for him to do much exploration. Shifting tides frequently move big ships which have settled to the bottom of the sea and consequently divers are often unable to locate the treasure.

The new diving sled is expected to overcome this. For in it, a diver can descend to the bottom of the sea and be towed for miles on the ocean's floor.

The diver takes his seat in a manner much the same as in an airplane. A tug takes up the tow and when ready to dive, the operator simply pushes forward on a joy stick, which is about the same as an airplane control. This in turn works the diving fins. The diver guides the right and left motion of his sled by use of rudder bars which in turn control the rudders.

The sled is easily controlled. It slips along the bottom of the sea until it encounters rocks or other obstacles, in which event the operator uses his control stick and zooms up over them, returning to the sea's floor when all is clear.



Drawn from the original, by Logan U. Heavis

Bringing the Sun Indoors

AT the Hayden Planetarium in New York a huge 26-foot image of the sun is being projected on the interior of the dome every day that the sun shines. This is accomplished by means of a first system of moving and fixed flat mirrors for bringing the sun's image indoors and a second system of mirrors and lenses for enlarging and projecting it.

The actual sun is shown at the top of the drawing. Its rays are caught by an eight-inch flat mirror mounted on an axis parallel with the earth's axis. A clock-like mechanism slowly turns this mirror as the earth's turning "moves" the sun. This image, after passing through an opening in the building, is kept constantly spotted on a second flat mirror which is permanently fixed in position. It in turn passes the image downward to the third element of the long optical train, a flat mirror

fixed at a 45-degree angle which turns it horizontally. The sun's image is now where it can be used but as yet it is neither magnified nor projected. Magnification is done in an ordinary eight-inch reflecting telescope, just as it would be if that telescope were directed at the sun out of doors; and since it is possible with any telescope to view the image not alone by looking into the eyepiece but also by projecting it on a screen at some distance from the eyepiece, the same is done at the planetarium. Here the distance is long, hence the image is very large—larger, in fact, than any solar image previously projected by similar methods. All this apparatus—the coelostat, fixed flats, and telescope—is entirely separate from the regular planetarium apparatus and could be similarly used with any ordinary house or building.

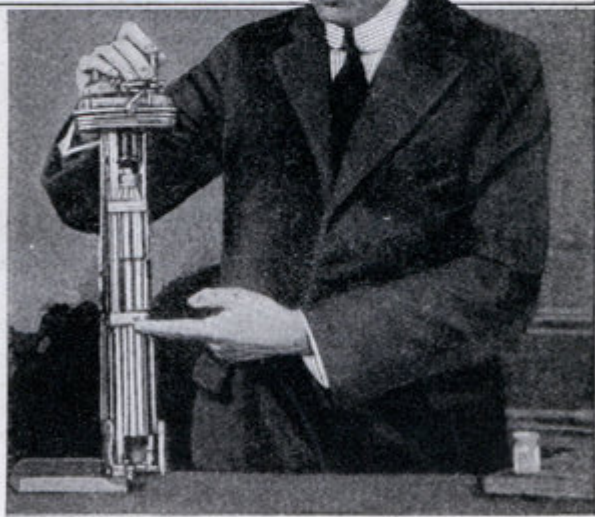
Amazing Turbine-Rocket



So-called "meteor islands," which can carry sun-reflecting mirrors and scientific instruments, can be established by shooting rockets at a 5-mile per second speed. Reaching a height of 65 miles, they would keep circling the earth, never coming down.

Prof. R. H. Goddard, famous rocket experimenter, has just patented a remarkable turbine-rocket which makes the age-old dream of traveling in space mechanically possible. Details of this astonishing invention and of other experiments which pave the way for regular lines of ships traveling through the earth's stratosphere at 1000 miles an hour are presented in this absorbing article.

DOWN in a secluded section of New Mexico a scientist who has for years been experimenting with rockets has succeeded in devising a mechanism combining the principles of the rocket and the turbine, giving the world an entirely new vehicle of transportation capable of traveling hundreds of miles above the earth's surface—and perhaps, some day, of making a trip to the moon or nearby planets.

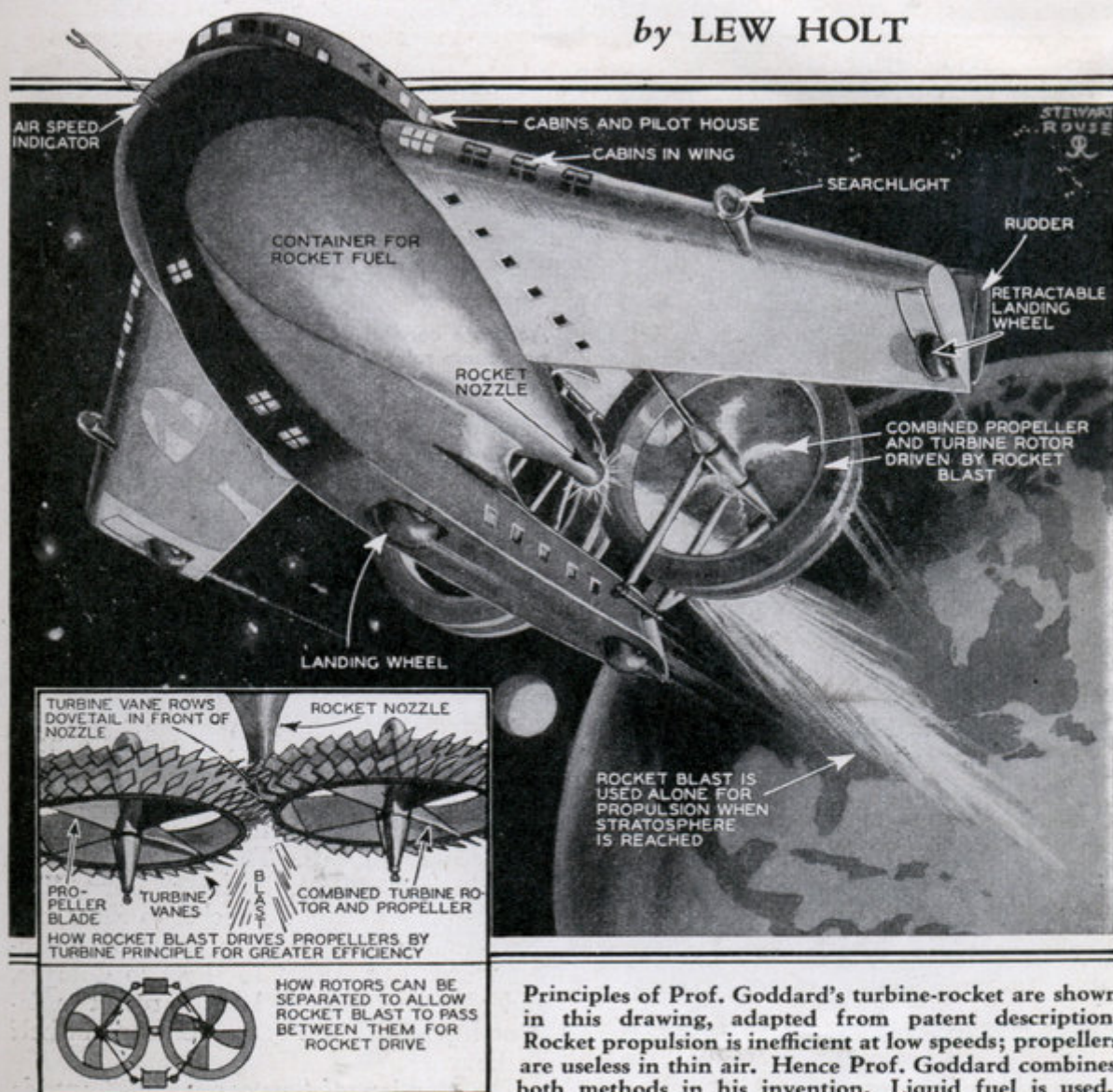


Prof. R. H. Goddard shown with a rocket model.

The scientist who has brought Jules Verne's moon trip a step nearer reality is Prof. R. H. Goddard of Clark University, who has just received a patent on his turbine-rocket airplane. He himself makes no claim that his machine will reach the moon—that statement comes from other enthusiastic scientists who see in his invention amazing possibilities of travel in outer space. Prof. Goddard has designed his ship

to EXPLORE Outer SPACE

by LEW HOLT



Principles of Prof. Goddard's turbine-rocket are shown in this drawing, adapted from patent description. Rocket propulsion is inefficient at low speeds; propellers are useless in thin air. Hence Prof. Goddard combines both methods in his invention. Liquid fuel is used.

to travel in the earth's stratosphere, which includes that layer of exceedingly thin air, trailing off into utter vacuum, which exists beyond ten miles above the earth's surface.

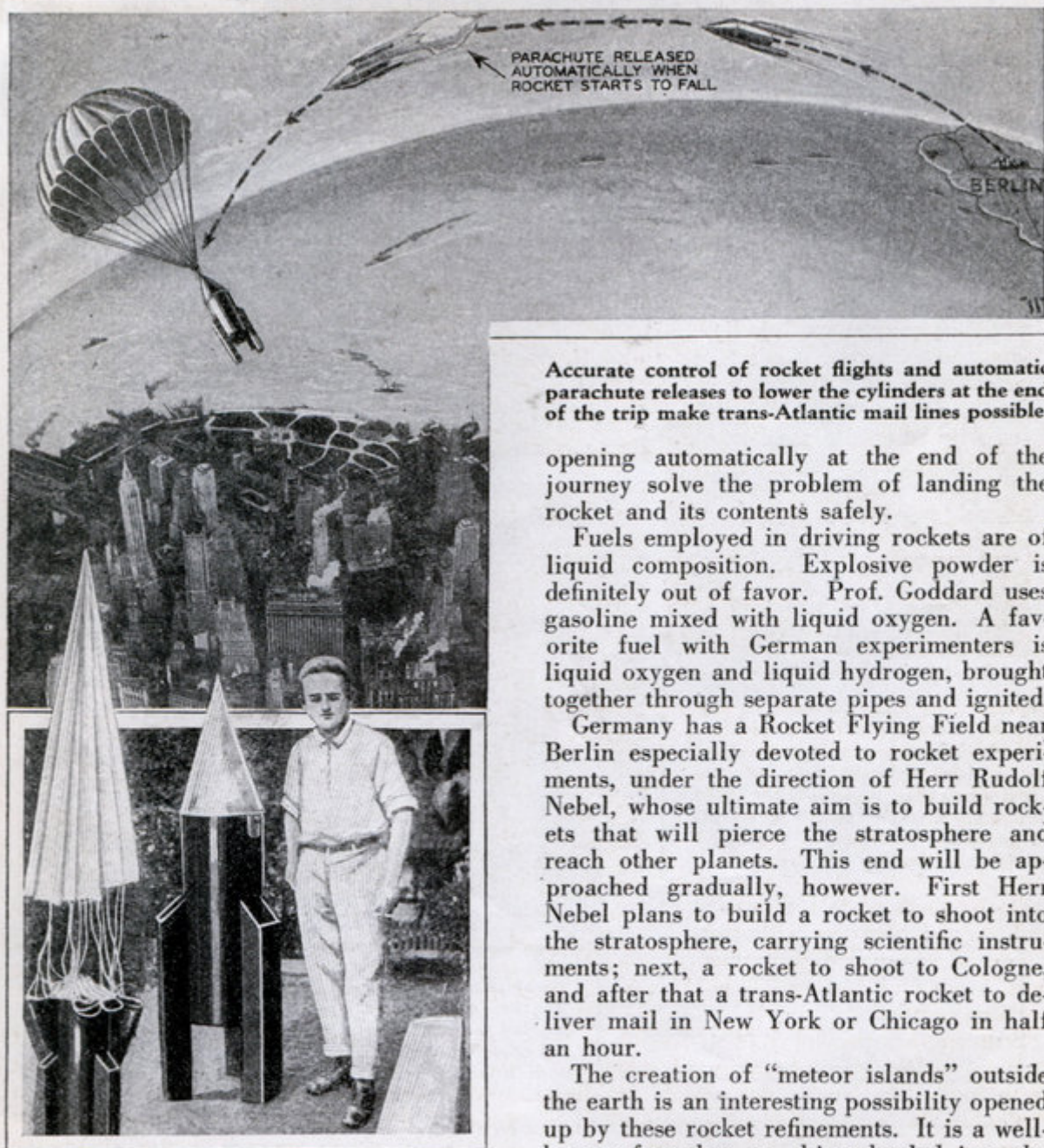
It is the combination of propellers and rockets which makes Prof. Goddard's ship unique. Rockets are the most efficient form of propulsion known for high speeds, meaning speeds in excess of 600 miles an hour. Airplane propellers are efficient at slow speeds and in dense atmosphere, but lose their effectiveness when the air thins out at high altitudes. Therefore Prof. Goddard combines these two forms of propulsion, as

explained in the drawing on this page.

In beginning its trip from the earth, the rocket blast of the ship is directed through turbine blades which drive propellers. This drive is used when traveling through the comparatively dense atmosphere close to the earth. But when the higher altitudes are reached, the propeller turbines are swung out of the course of the rocket blast so that the ship is driven by rockets alone. Thus the two forms of power are used under their most favorable conditions.

Whenever the subject of rockets is mentioned, the imagination conjures up pictures of journeys to the moon and planets.

German Mail-Line Rocket Perfected, Landing Self by Use of Parachute



Above rocket, equipped with a 'chute, has been successfully tested by Wilhelm Belz, German engineer.

Scientific skeptics have always maintained that such ideas are fantastically impossible, but much of this criticism has been quieted recently by the experiments of Goddard and others. German experimenters, particularly, have perfected rockets to such an extent that one group has already charted a course from a field in Germany to one near New York, over which course rockets carrying mail or merchandise will travel. Parachutes

Accurate control of rocket flights and automatic parachute releases to lower the cylinders at the end of the trip make trans-Atlantic mail lines possible.

opening automatically at the end of the journey solve the problem of landing the rocket and its contents safely.

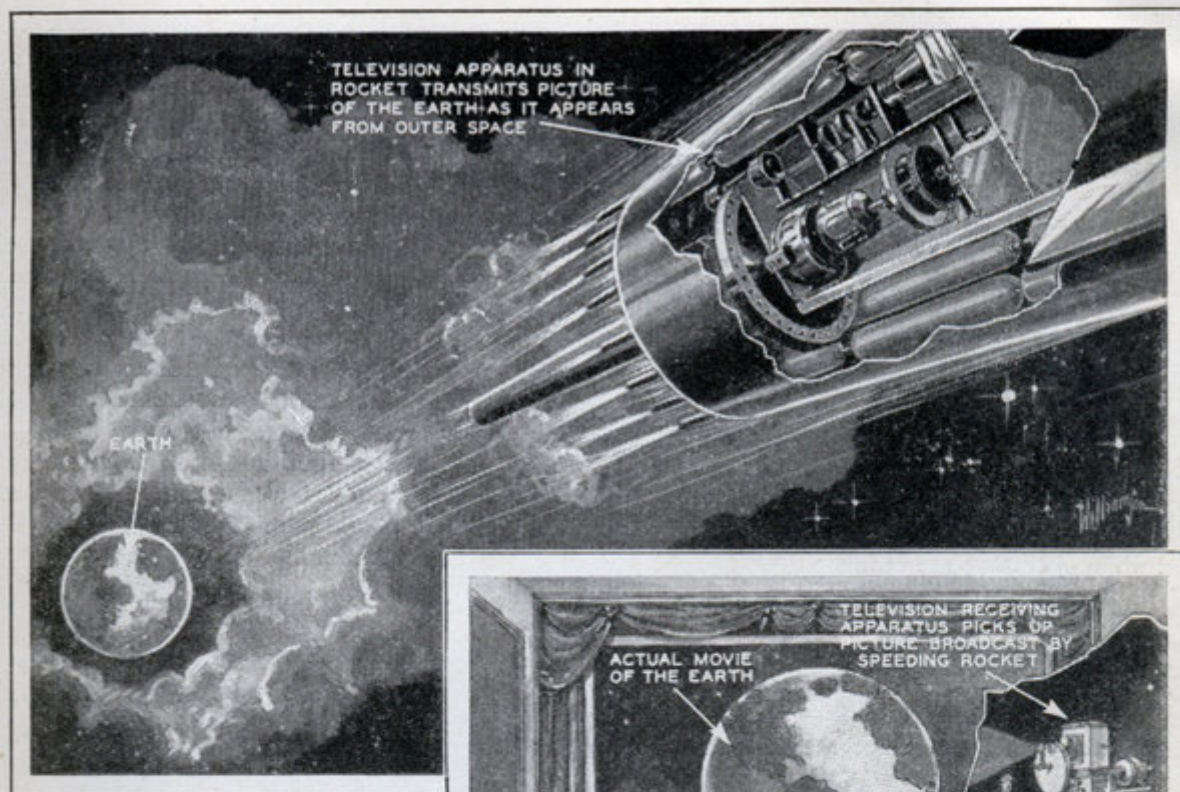
Fuels employed in driving rockets are of liquid composition. Explosive powder is definitely out of favor. Prof. Goddard uses gasoline mixed with liquid oxygen. A favorite fuel with German experimenters is liquid oxygen and liquid hydrogen, brought together through separate pipes and ignited.

Germany has a Rocket Flying Field near Berlin especially devoted to rocket experiments, under the direction of Herr Rudolf Nebel, whose ultimate aim is to build rockets that will pierce the stratosphere and reach other planets. This end will be approached gradually, however. First Herr Nebel plans to build a rocket to shoot into the stratosphere, carrying scientific instruments; next, a rocket to shoot to Cologne, and after that a trans-Atlantic rocket to deliver mail in New York or Chicago in half an hour.

The creation of "meteor islands" outside the earth is an interesting possibility opened up by these rocket refinements. It is a well-known fact that an object hurled into the air at a speed of some six miles an hour will, after reaching an altitude of 65 miles, remain there forever, traveling around the earth. Owing to the earth's curved surface and its rotation, the object cannot come down.

Such islands in space, Herr Nebel declares, can be devoted to innumerable purposes. Fitted with huge natrium mirrors, they can divert the sun's rays to illuminate the earth at night. They can be fitted with astronomical instruments. They can be used as stopping points for rockets

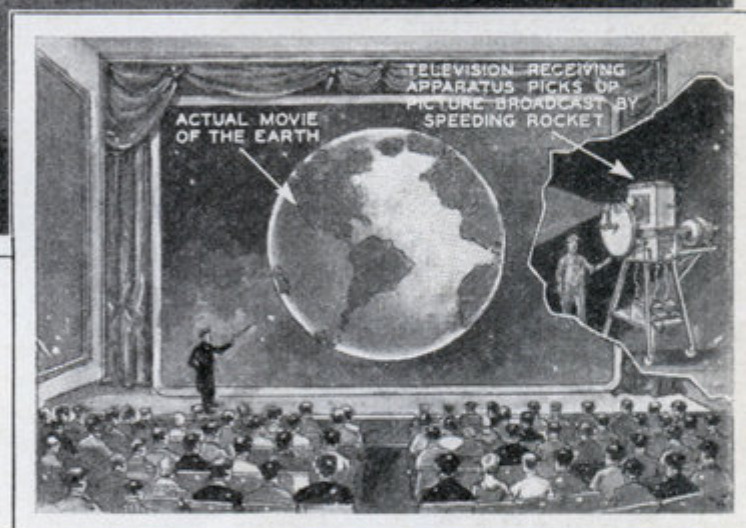
"See the Earth as Other Planets See It"—via Ingenious Television Rocket



Experts who have listened to the plan of Maxium Pudovkin for placing television apparatus in a rocket for a long-distance view of the earth agree that the idea is far from fantastic. Rockets can be accelerated gradually so shock of explosion would not destroy the apparatus.

carrying passengers into space, and can be outfitted with provisions to sustain a staff of scientists. Fantastic? Certainly—but not impossible.

Still another use for rockets would be to give us a long-distance view of what our earth looks like from outer space. Maxium Pudovkin, a young Russian engineer and inventor, has proposed that television equipment be installed in a rocket and a moving-picture of the earth be projected from it as the rocket travels toward the moon. The practical man may object that a rocket's vibration would destroy delicate television equipment, but as a matter of fact rockets are now so well designed that they start with less jerkiness than an ordinary airplane. The value of a "space-visor" in checking up on maps and geographies is self-evident. It would be a simple matter to keep a photographic record of the television image.



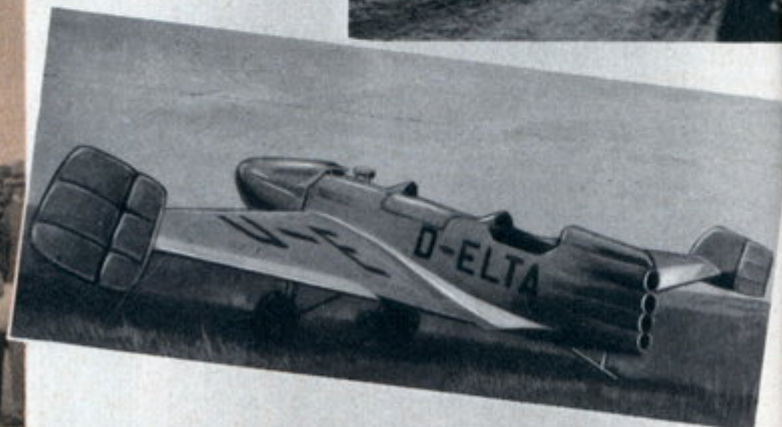
Some day you may enjoy the thrill of watching a motion picture of the earth, transmitted by television from a rapidly moving rocket in outer space! A record could be kept by photography.

Although Prof. Goddard will not predict the exact distance which his turbine-rocket airship would be capable of traveling, in a paper written some years ago he proved that a series of rockets, one within the other, each fired as the one below became empty of fuel, could reach an indefinitely great height. It is uncertain when a turbine-rocket will be built from Prof. Goddard's plans, although models have already been constructed. In one model the turbine blades, of thin steel, were insecurely mounted to the rim, and they were thrown more than 50 feet by the high speed produced by the rocket blast. The speed of the rocket, where maximum efficiency is produced, will be in the neighborhood of 3000 miles an hour. Even at this great speed it would take 80 hours to reach the moon.

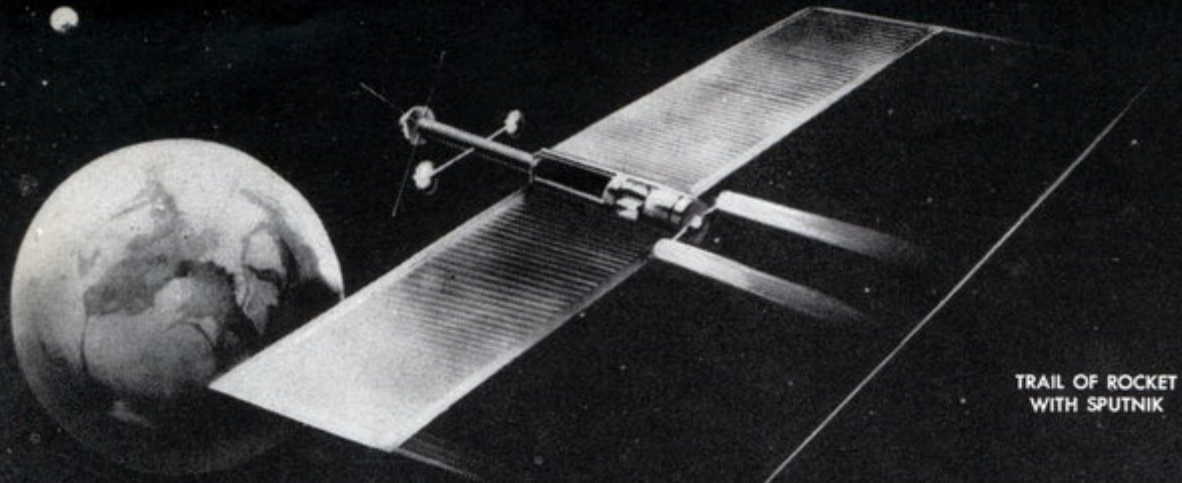
Prophetically depicting what future commercial rocket flight "space ships" will look like, a recent motion picture features scenes showing a passenger rocket taking off from a long runway (left) and another super-rocket ship being nosed out of its hangar (left center) in preparation for a transcontinental flight at speeds surpassing 1,000 miles per hour. Bona fide rocket experimenters, however, acknowledge that it will be a long time before passenger rockets will be practical.

ROCKET FLIGHT— Dream Or Reality?

In the photo at right, an experimental rocket is seen just at the moment of leaving the ground. Rockets do not have to be shot into the air in order to conduct tests, but are usually "launched" on a proving stand, special instruments indicating power, rate of climb, and other data.



Much in the manner of pioneer aircraft experimenters, groups of rocket fans are constantly seeking to improve rocket flight in an effort to hasten the day when commercial rocket travel will be practical. Left—German experimenters with a newly developed rocket. Above—Test plane fitted with a rocket motor at tail. Rocket motors have also been tested in boats and automobiles.



TRAIL OF ROCKET
WITH SPUTNIK

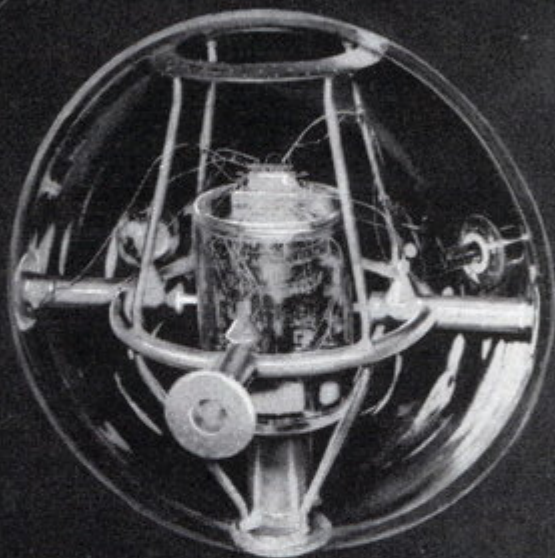
ION-PROPELLED
SPACE VEHICLE



BALLOON-LAUNCHED
FAR SIDE ROCKET
SOARS 4000 MILES

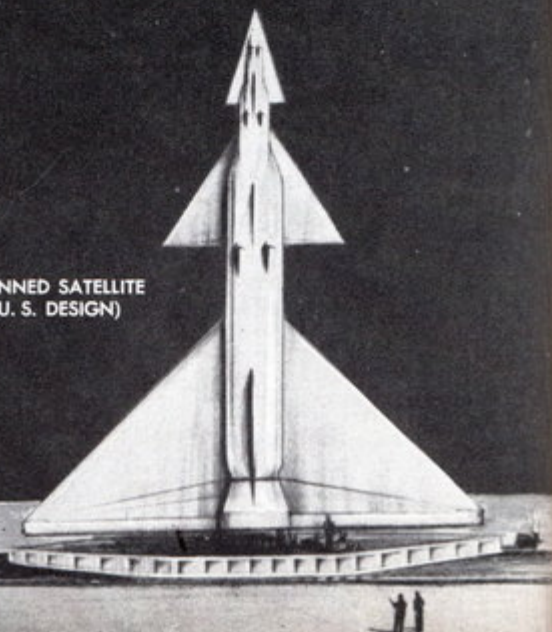


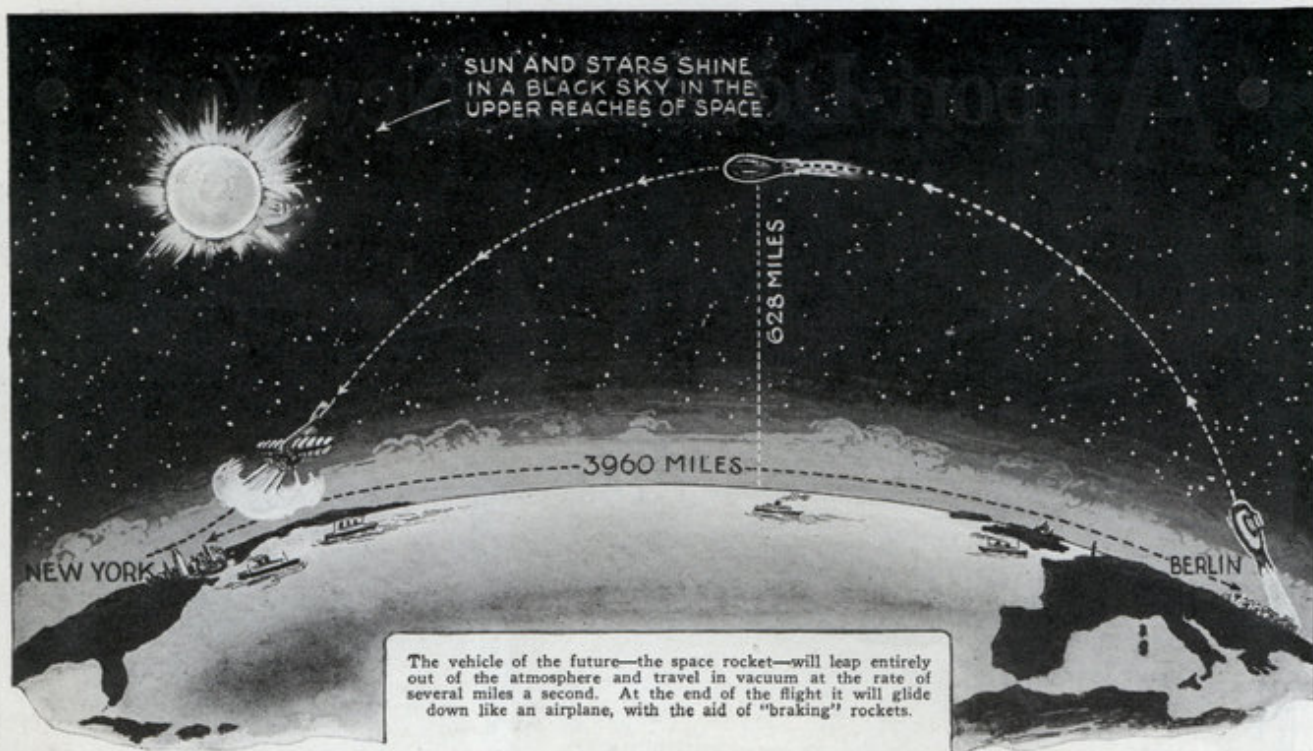
FAR SIDE ROCKET



U. S. SATELLITE

MANNED SATELLITE
(U. S. DESIGN)





• Berlin to New York in less than One Hour! •

By HUGO GERNSBACK

IT is a curious failing of human nature that it is inclined to pooh-poooh new and scientific ideas, particularly if they deal with high speeds. If you had told that master of extravagant imagination, Jules Verne, at the time he wrote his story "Around the World in Eighty Days," that in 1931 flyers would circle the earth in nine days, he probably would have taken it as a good joke. Nevertheless, facts speak for themselves; and the circumnavigation of the globe has actually been accomplished in nine days. That it will soon be circled in twenty-four hours, no one now doubts.

But, when we come to the higher speeds of travel, even the well-educated man becomes highly skeptical for no reason at all. Such people in their simplicity constantly forget that, every day in their lives, they themselves are travelling at the rate of 65,000 miles an hour (I refer, of course, to the speed at which the earth circles around the sun.) Yet, not one of these skeptics feels this so-called tremendous speed at all; for the simple reason that speed, like everything else, is relative.

When the Wrights flew in their first airplane, it did about 35 miles an hour. Airplanes have actually made 400 miles per hour, up to the present time; and new and higher speeds crowd out former records almost daily.

Of course, there must be a limit to the

speed of flying in the atmosphere; for at a certain speed, in this dense medium, at sea level or a hundred feet above it, the machine would go up in smoke, because of the tremendous friction created. We have only to look at the night sky and see what happens when a meteor strikes the outer, and much more tenuous, atmosphere at a speed of some seven to ten miles per second. For this reason, the really fast flying of the future must, of course, be done at the higher altitudes. It will be necessary to leave the atmosphere entirely and go above it in velocities proposed here, which are astonishing yet nevertheless, even today, quite practicable. All we require is a rocket flying machine, which makes use, not of propellers, but of the reaction of its exhaust gases to send it forward.

Already, many such rocket machines have been constructed; and every day newspapers report new experimental rocket devices which operate cars and airplanes by means of this system of propulsion.

Of course, we have not, as yet, a satisfactory and economical rocket engine. The reason is that the art is, as yet too new and not enough research work has been done. This will come later; since developments of this sort must always be gradual.

With the present proportions between the weight of the fuel and that of the

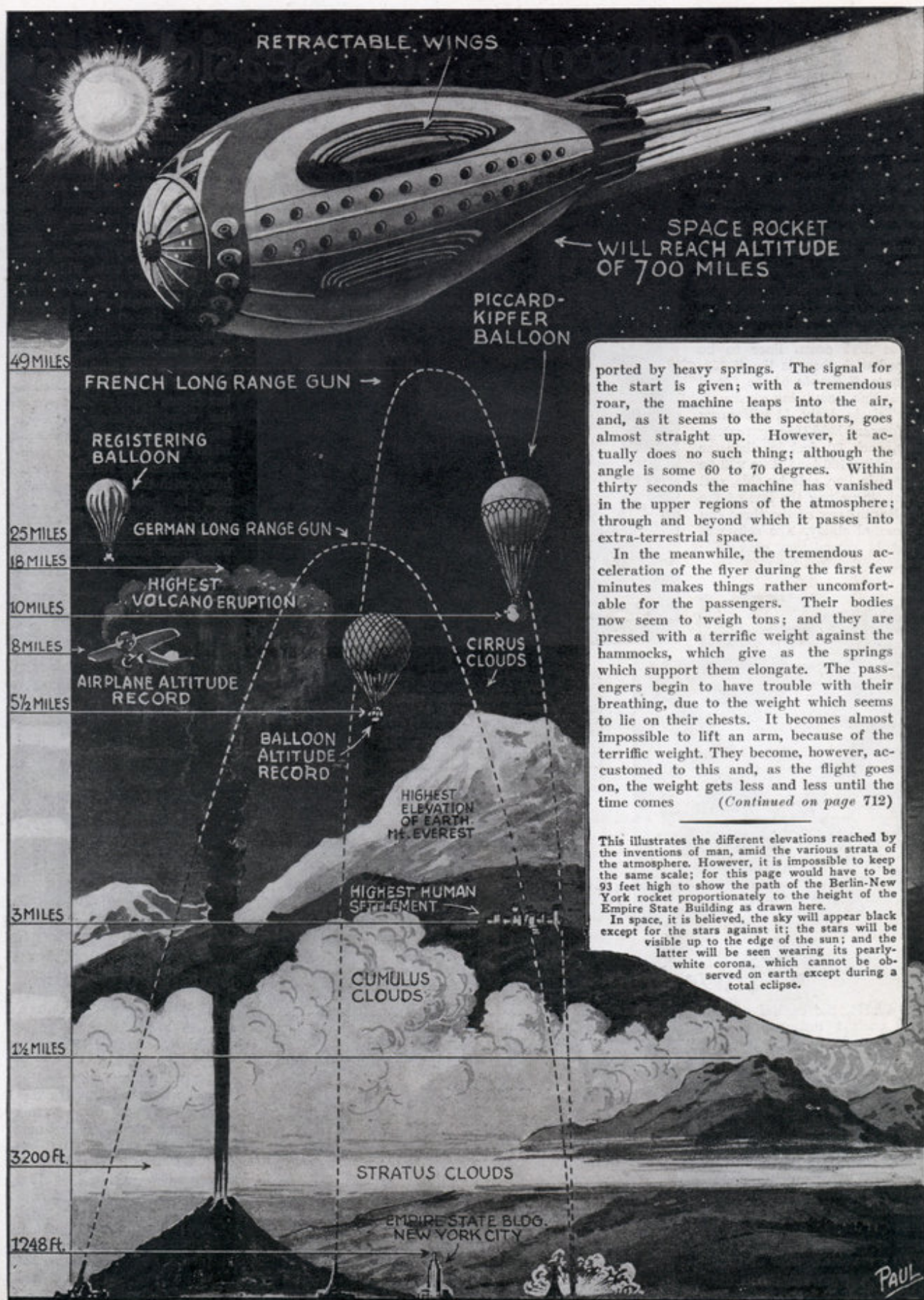
rest of the flyer, the former is so great that you need over 90% of the available space for fuel, and have left only 10% for cargo. This makes the venture economically unprofitable and, for that reason, no big machine has, as yet, been constructed.

There is, of course, another important problem and that is a machine of this kind must be hermetically sealed because it flies *above the atmosphere*, in a partial vacuum, and the car must be equipped to take along its own oxygen, and its own machinery to renew the air. This problem, however, need not worry us; because submarine engineers already have solved the problem for us in a very efficacious manner.

The real problem today is centered in the one word—"Fuel." Once this has been solved, the flight from Berlin to New York, and *vice versa*, in one hour or, under certain circumstances, much less, is no longer a dream. As a matter of fact, I am certain that such a flight will be made during the next fifteen years, and perhaps much sooner.

A Flight into Empty Space

LET us see how this flight is going to work out. Our metallic flyer is placed on a metal runway and, after the doors have been hermetically sealed, the passengers are required to lie in hammocks which are sup- (Continued on next page)



ported by heavy springs. The signal for the start is given; with a tremendous roar, the machine leaps into the air, and, as it seems to the spectators, goes almost straight up. However, it actually does no such thing; although the angle is some 60 to 70 degrees. Within thirty seconds the machine has vanished in the upper regions of the atmosphere; through and beyond which it passes into extra-terrestrial space.

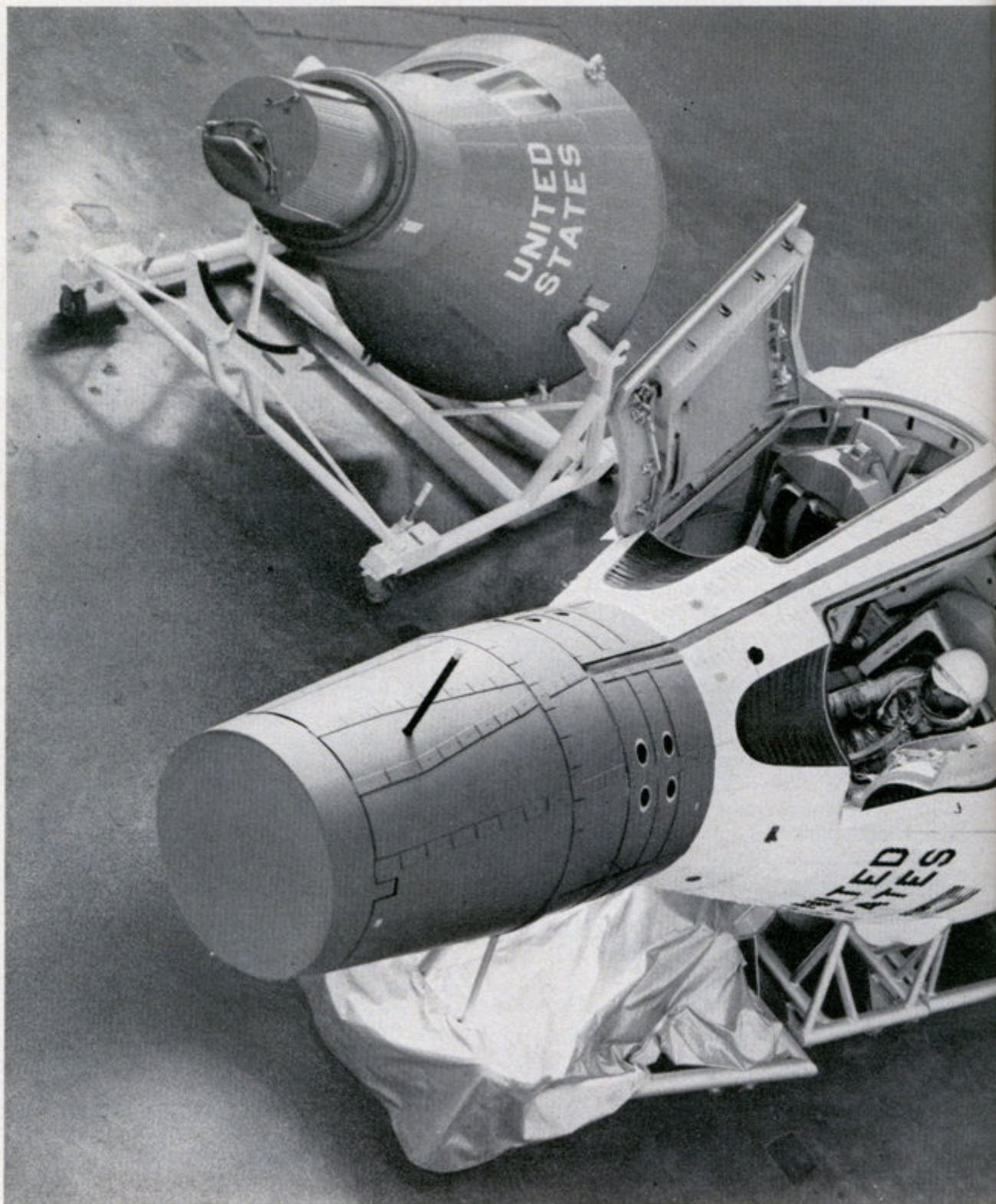
In the meanwhile, the tremendous acceleration of the flyer during the first few minutes makes things rather uncomfortable for the passengers. Their bodies now seem to weigh tons; and they are pressed with a terrific weight against the hammocks, which give as the springs which support them elongate. The passengers begin to have trouble with their breathing, due to the weight which seems to lie on their chests. It becomes almost impossible to lift an arm, because of the terrific weight. They become, however, accustomed to this and, as the flight goes on, the weight gets less and less until the time comes (Continued on page 712)

This illustrates the different elevations reached by the inventions of man, amid the various strata of the atmosphere. However, it is impossible to keep the same scale; for this page would have to be 93 feet high to show the path of the Berlin-New York rocket proportionately to the height of the Empire State Building as drawn here.

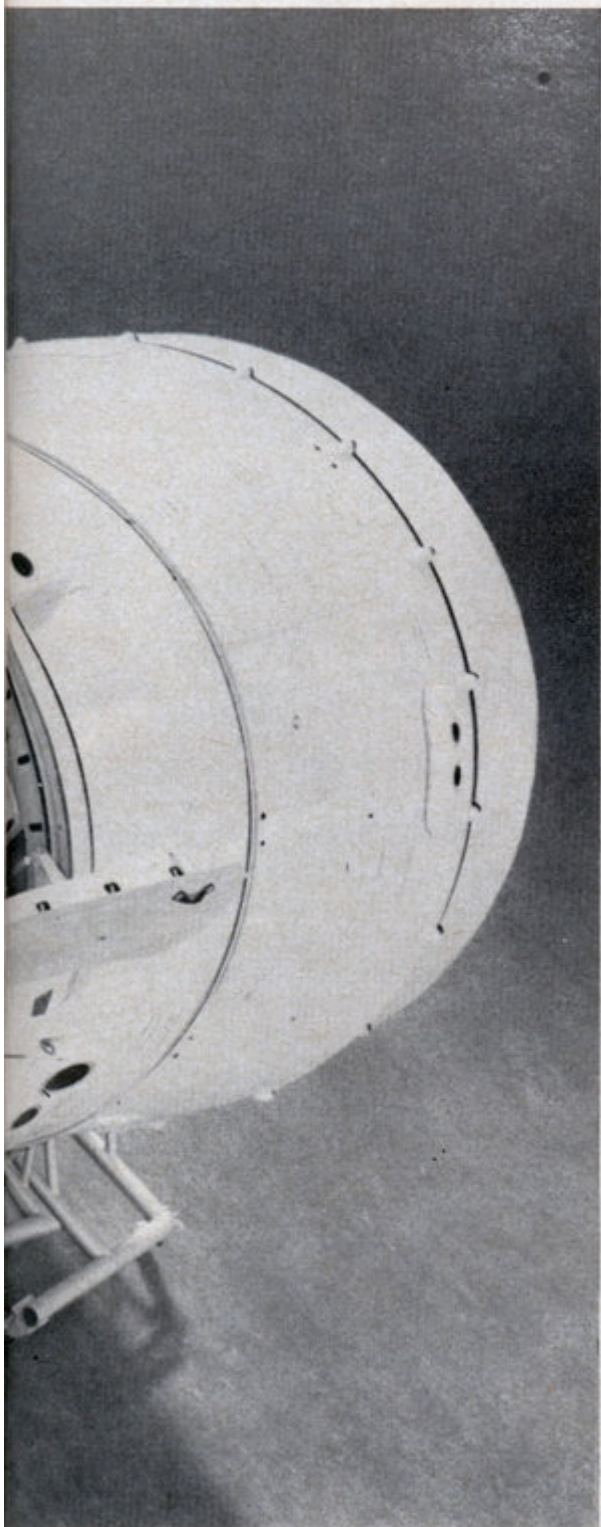
In space, it is believed, the sky will appear black except for the stars against it; the stars will be visible up to the edge of the sun; and the latter will be seen wearing its pearly-white corona, which cannot be observed on earth except during a total eclipse.

The Gemini mission—what it will be like . . .

Inside Our First Two-Man



Spacecraft



Getting ready: Scheduled to be first Gemini astronauts, pilot Gus Grissom (foreground) and copilot John W. Young try out their cockpit, which is much roomier than the Mercury capsule.

Not just a scaled-up Mercury capsule, the Gemini spacecraft is a ship for astronauts to fly

By Wesley S. Griswold

WITHIN the next few months, for the first time in our space program, two U.S. astronauts are expected to go into orbit together.

Their vehicle, the Gemini spacecraft, is far more than just a Mercury built for two. Besides being half again as roomy and twice as heavy as Mercury was, it is much more complex and efficient. That is because it will have many intricate tasks to perform before it completes its 12 scheduled missions.

Those missions will include flights lasting as long as two weeks. They will include practice rendezvous with another spacecraft in orbit (an Agena D rocket will play the supporting role). After rendezvous, Gemini will try space-docking, by sliding its nose into a socket in one end of the Agena D. In addition, Gemini's two astronauts will depressurize

CONTINUED

◀ Gemini capsule is shown compared with Mercury at McDonnell Aircraft, St. Louis. Gemini is more sophisticated, weighs about twice as much (7,000 pounds).

Gemini pilots have to fly the ship—it can't be controlled

their cabin, open its hinged hatches, and take turns floating about on tethers, as future astronauts must be able to do if they are to make repairs en route or build space stations in orbit.

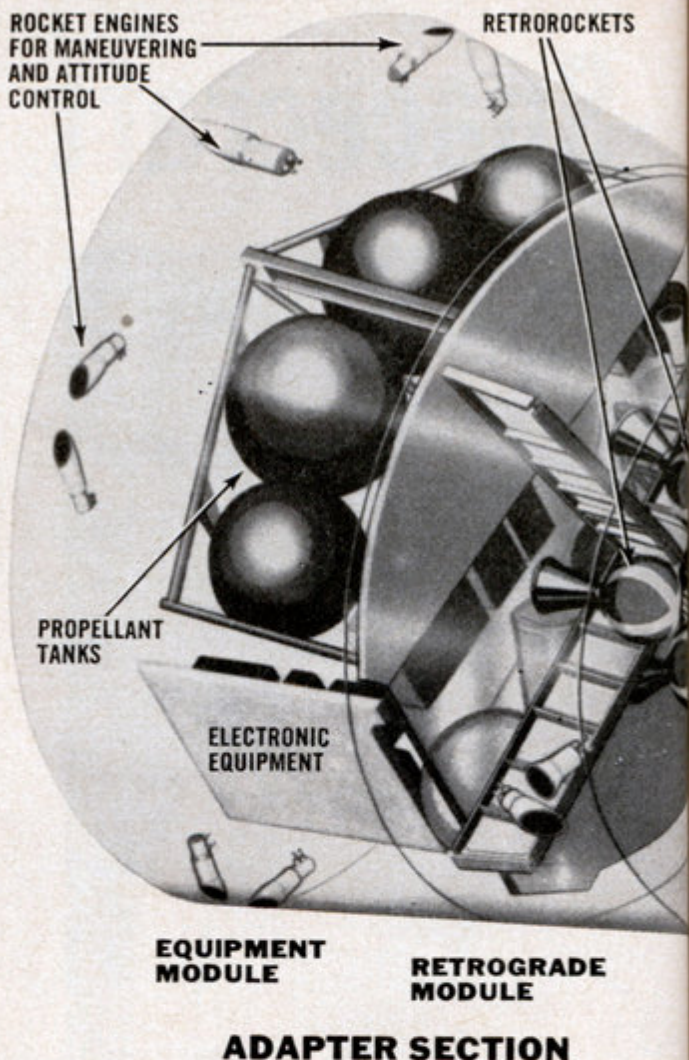
All these demanding and perilous maneuvers must be tried out and perfected before the first manned journey to the moon can be undertaken with confidence.

Gemini's first flight. The more dramatic events will not take place on the first flight. It will be simply a three-orbit journey, lasting about four hours and a half. But in that brief time, Astronauts Virgil I. (Gus) Grissom and John W. Young will use as much as possible of the complicated equipment.

Mercury, in which all essential systems shared the cabin with its sole occupant, was as uncomfortable as a crowded broom closet. On Gemini, everything that can be put out of the astronauts' way has been stowed elsewhere. This was achieved partly by packaging the systems, partly by housing them in the outer section of a doubly constructed re-entry module, and partly by locating them in the adapter section, at the base of the spacecraft.

The crew's pressurized cabin forms the core of the re-entry module. The space between it and the outer shell is filled with instrument packages, electronics gear, and landing gear. This arrangement provides greater protection from micrometeorite damage, as well as greater comfort, than Mercury afforded. Retro-rockets, fuel for positioning thrusters, batteries, and the main oxygen supply occupy the adapter section, shed before Gemini returns to the earth's atmosphere.

Mercury's capsule was launched with an escape tower attached, which would have rocketed the entire module out of harm's way if the launching rocket had misfired. Gemini provides its pilot-commander with gauges that tell him precisely how its Titan II booster is behaving. If he reads trouble on the dials, he'll pull a ring beside one knee and catapult both himself and his copilot



out of the module in rocket-fired ejection seats. There's a ring at each seat, and pulling either one ejects both seats. This could be done, if necessary, during re-entry as well as during launch.

Mercury had a small reaction-control system that let its astronaut change the attitude of his craft in space, but not its orbit.

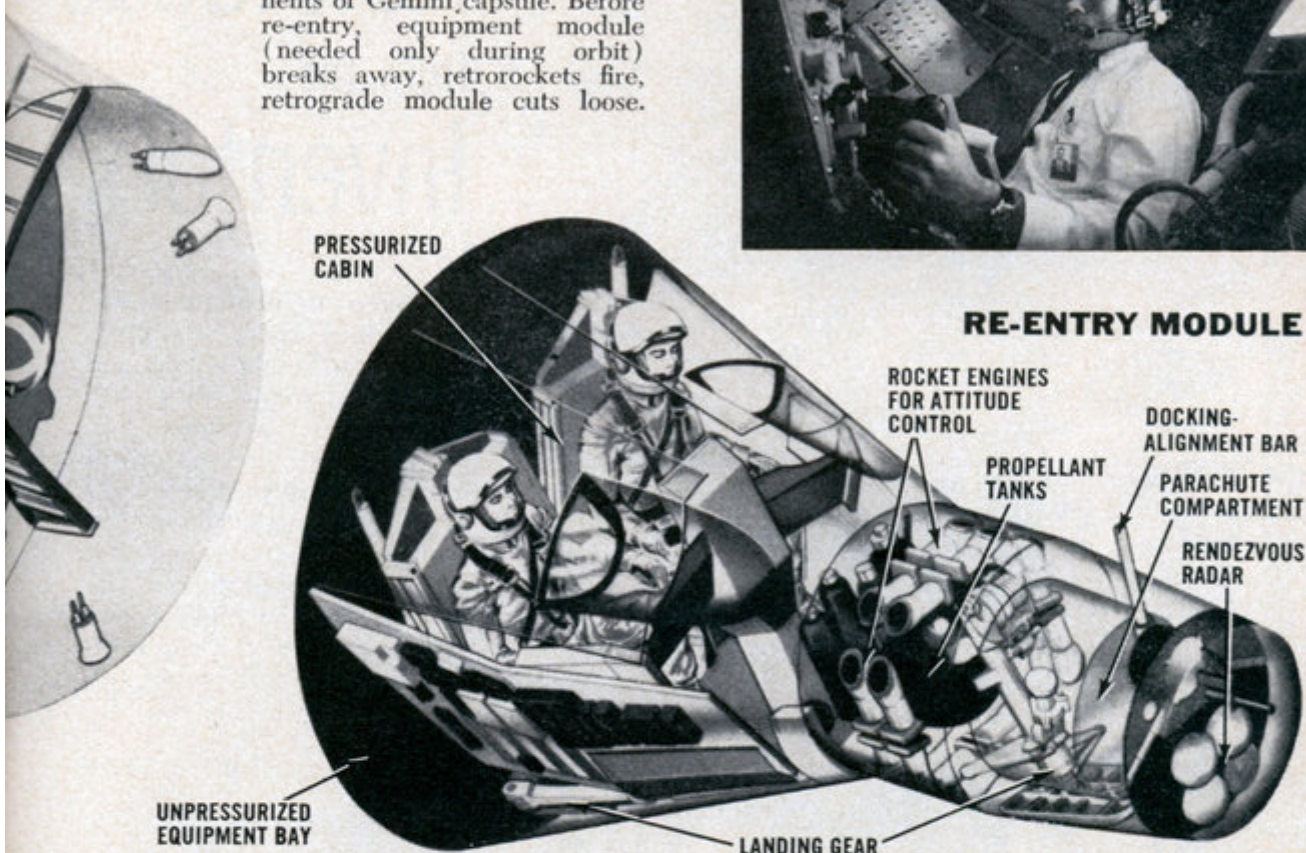
Gemini will be able to move forward and backward in any direction, up and down, and sideways. Thrust for these moves will come from a range of impulses, provided by a hypergolic mix of monomethyl hydrazine and nitrogen tetroxide.

Despite its maneuverability, piloting Gemini will not be much like driving a car. When it changes speed, it also changes the shape of its orbit, and thus its altitude.

from the ground

Astronaut Young tries out left-hand attitude-control stick in one of many flight simulations.

Cutaway shows major components of Gemini capsule. Before re-entry, equipment module (needed only during orbit) breaks away, retrorockets fire, retrograde module cuts loose.



Whereas Mercury could be under completely automatic control, either from the ground or from on-board gyros, Gemini is almost entirely under control of the men aboard. It cannot be commanded from the ground. The pilot—or, if he's incapacitated, the copilot—must initiate an emergency exit, if needed, and also must trigger the re-entry system.

Docking. Gemini has a radar, with a 250-mile range; an inertial-guidance platform; and a manual-feed electronic computer, weighing only 57.6 pounds and taking up one cubic foot. Mercury had none of these, and had no need for them. They are essential, however, to Gemini's forthcoming tasks of meeting another spacecraft in orbit and docking with it.

This delicate and difficult job of closing on another vehicle in space when both are going 18,000 m.p.h. can be done

automatically if the Gemini pilot chooses, or semiautomatically, or under the pilot's own control.

He needs to know the speed, distance, and direction that will take him to his target. Once the Gemini spacecraft is within 250 miles of the Agena D, its inertial-guidance platform and computer can get this essential information from the radar and guide the craft toward its target without help from the pilot. But if he prefers, the computer will provide him with a readout of the necessary data and he can act on it himself. In the last few feet before docking, the pilot will probably rely wholly on his own vision, judgment, and manual control.

Docking will involve a speed differential of only about 1½ m.p.h. between

[Continued on page 201]

Skyrocketing to

Rocket machines operate more efficiently in the vacuum of interstellar space than in an atmosphere. Will science be able to harness this new force for interplanetary travel?

SCIENTISTS say that in the next few months we may see the first trials of man-carrying rockets, which will be shot off into space in an effort to land some intrepid adventurer on Venus or Mars!

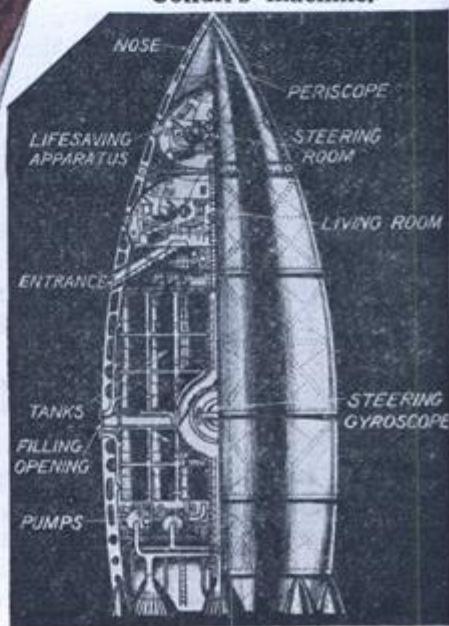
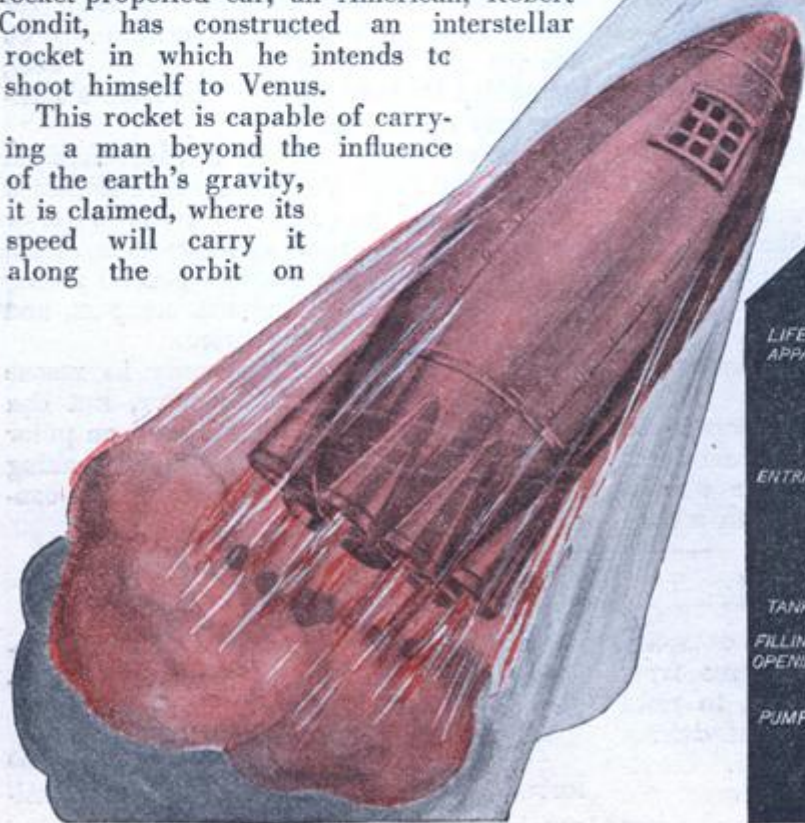
Visions of a Jules Verne voyage to another planet are actually nearing realization through the lessons learned from recent rocket tests made by Fritz von Opel and Anton Raab, two Germans who have made exhaustive studies of rockets as a means of propulsion.

Through lessons learned from applying the rocket-propelling principle to the Opel rocket-propelled car, an American, Robert Condit, has constructed an interstellar rocket in which he intends to shoot himself to Venus.

This rocket is capable of carrying a man beyond the influence of the earth's gravity, it is claimed, where its speed will carry it along the orbit on



Robert Condit, above, is shown adjusting the rockets of the machine which he hopes will carry him to Venus. Below is a diagram of the working parts of Condit's machine.



Mars!

*Will Man Ever Reach
the Red Planet?*

Mars is 39,000,000
miles from the earth.
A rocket could reach it
in two and a half years.

which it is aimed until it
reaches the gravitational in-
fluence of another planet.

Large tubes project tailward, emitting the
chemically produced gases, which by their
jet propulsion shoot the rocket into the
heavens.

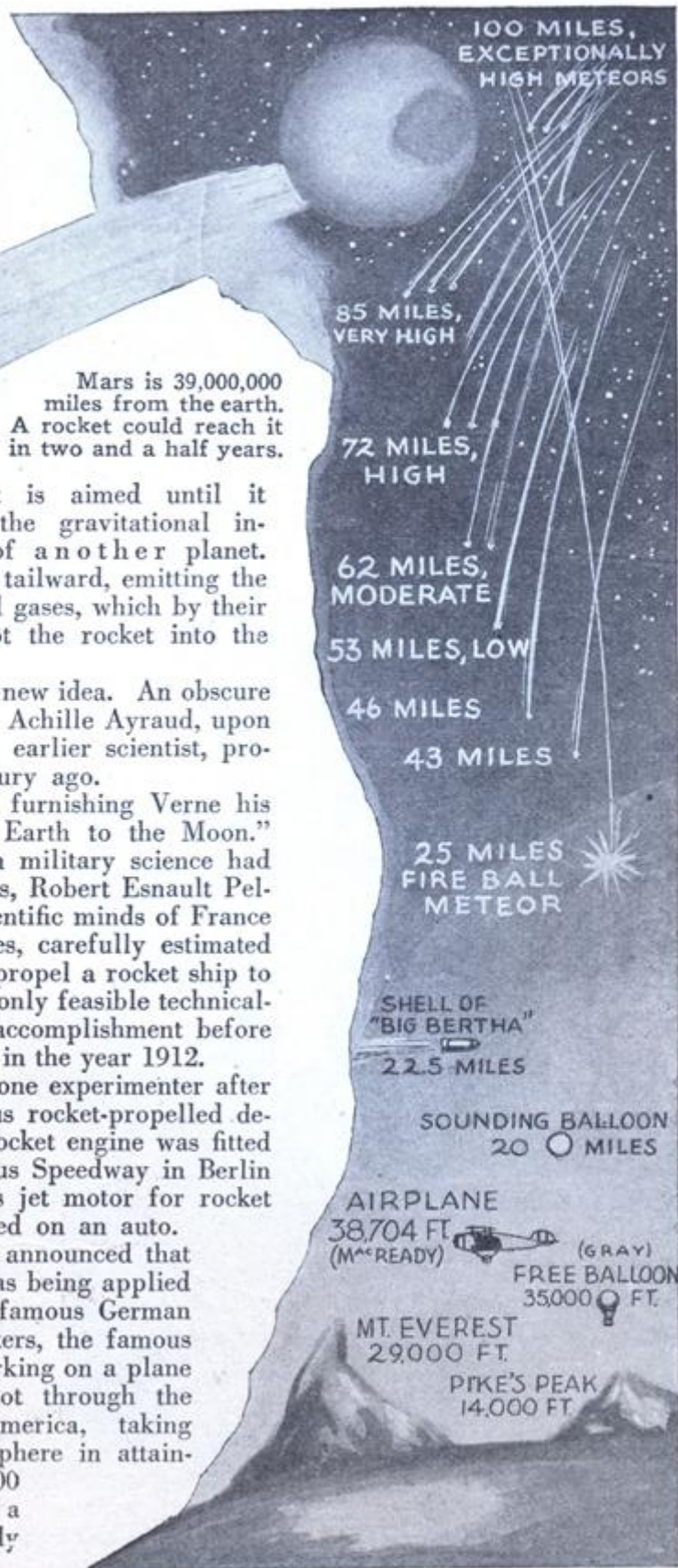
Astronautical voyages are not a new idea. An obscure
contemporary of Jules Verne, one Achille Ayraud, upon
coming across notes made by an earlier scientist, pro-
posed a trip to the moon a century ago.

This is the idea credited with furnishing Verne his
theme for the story "From the Earth to the Moon."

After Jules Verne's time, when military science had
advanced to the study of ballistics, Robert Esnault Pel-
terie, one of the most original scientific minds of France
and a noted designer of airplanes, carefully estimated
the weights and forces needed to propel a rocket ship to
the moon, and found the idea not only feasible technical-
ly, but projected a plan for its accomplishment before
the Societe Francaise de Physique in the year 1912.

From that time to the present, one experimenter after
another has made tests on various rocket-propelled de-
vices. One May day in 1928 a rocket engine was fitted
to an Opel special car at the Avus Speedway in Berlin
to see what effect such a gaseous jet motor for rocket
driving would have when installed on an auto.

At about the same time it was announced that
the rocket propulsion principle was being applied
to the airplane by Anton Raab, famous German
aviator. It is rumored that Junkers, the famous
German plane builder, is also working on a plane
which will be designed to shoot through the
heavens from Europe to America, taking
advantage of the rarefied atmosphere in attain-
ing the enormous speed of 300
miles an hour while carrying a
load of passengers in a hermetically
sealed cabin.



Daring Men in Seven Nations Aim to Harness GIANT ROCKETS



Above, the apparatus from which a test rocket is launched or which is used to hold the rocket motor in fuel experiments. At right, a small rocket is put in the launching machine.



Above, from a distant hill a group of engineers witness an explosion on a rocket field in the course of experiments seeking an efficient fuel. At left, those who use powerful explosives to propel rockets now wear asbestos suits to guard against fire.

FIFTEEN years ago the rocket was a toy, fit only for fireworks or laboratory demonstrations. Twelve years ago only one scientist in the world, the American physicist, Dr. Robert H. Goddard, of Clark University, Worcester, Mass., was working to transform this ancient plaything into a source of power for fast vehicles. So rapid has progress been, since then, that today the rocket is a young giant, though as yet too impetuous and uncontrolled for commercial use.

Scientists and daring men of seven countries, including the United States, are making serious and audacious tests that may soon solve the problems connected with this form of transportation.

A few weeks ago I visited the Raketenflugplatz at Berlin, the world's most extensive experimental ground for the study of rockets. It lies in Reinickendorf, not five miles from the heart of the German capital, and sprawls northward into the hilly, tree-protected country surrounding the metropolis. At this plant, larger than the famous flying field at Tempelhof, six engineers are working seven days a week to accomplish the miracle of harnessing giant rockets.

The name Raketenflugplatz means "rocket flying field." It was not without design for the future that the Verein für Raumschiffahrt, the German society sup-

porting these experiments, laid out so large a field. Within five years, the engineers there have predicted, rockets carrying mail will leave and arrive at the Raketenflugplatz on schedules, connecting all Europe by fast projectiles.

When this first objective has been safely accomplished, the workers of the German society will be ready to try a more ambitious project. This will be the shooting of a mail rocket across the Atlantic, to land somewhere near New York, with a cargo of letters or valuable express.

Such transatlantic rockets will be the forerunners of great rocket ships built to carry crew and passengers. They will cross the ocean from New York to Berlin in an hour, or two hours at the most, rising through the thick lower atmosphere on wings like those of an airplane, then speeding through the upper part of their



course, perhaps five hundred miles above the surface of the globe, at an estimated speed of 3,000 miles an hour.

The chief engineers of the Raketenflugplatz are Rudolf Nebel, Willy Ley, and Klaus Reidel. They have announced that transatlantic passenger flights will not content them. Supported by a society of more than 1,000 enthusiasts, these German engineers hope some day to launch from their rocket field a bullet-shaped craft destined for the moon or one of the planets. They see no theoretical reason why it cannot be done, though difficult mechanical problems raise many practical

This article tells you the sensational facts the author learned while making a personal tour of the world's rocket fields where elaborate tests are now under way.

By G. EDWARD PENDRAY

obstacles. But one by one, through the cooperation of rocketors and scientists all over the world, these are being overcome.

IT MUST not be assumed that, because their project is the largest, the Germans are the only ones working on the rocket problem, or indeed that the Raketenschlagplatz is the only place in Germany where experiments are under way.

At present there are groups and individuals working in Germany, Austria, France, Italy, Russia, Roumania, and the United States to solve the technical barriers to the use of this new engine. In each of these countries the program is essentially the same—first an altitude rocket that will go up fifty, a hundred, or two hundred miles, to the extreme limit of the earth's atmosphere, driven by powerful liquid fuels and properly equipped with scientific apparatus and a parachute to bring both rocket and instruments safely back to earth. Then mail rockets, under control from start to destination, shooting between cities, bearing commercial traffic at enormous speeds, to be followed by rockets capable of crossing the oceans or encircling the world, carrying freight and passengers. Finally, powerful ships of space, roaring to the moon or to our other neighbors in interplanetary space.

As you read these words, the first high altitude rocket may be hurtling upward from any one of nearly a

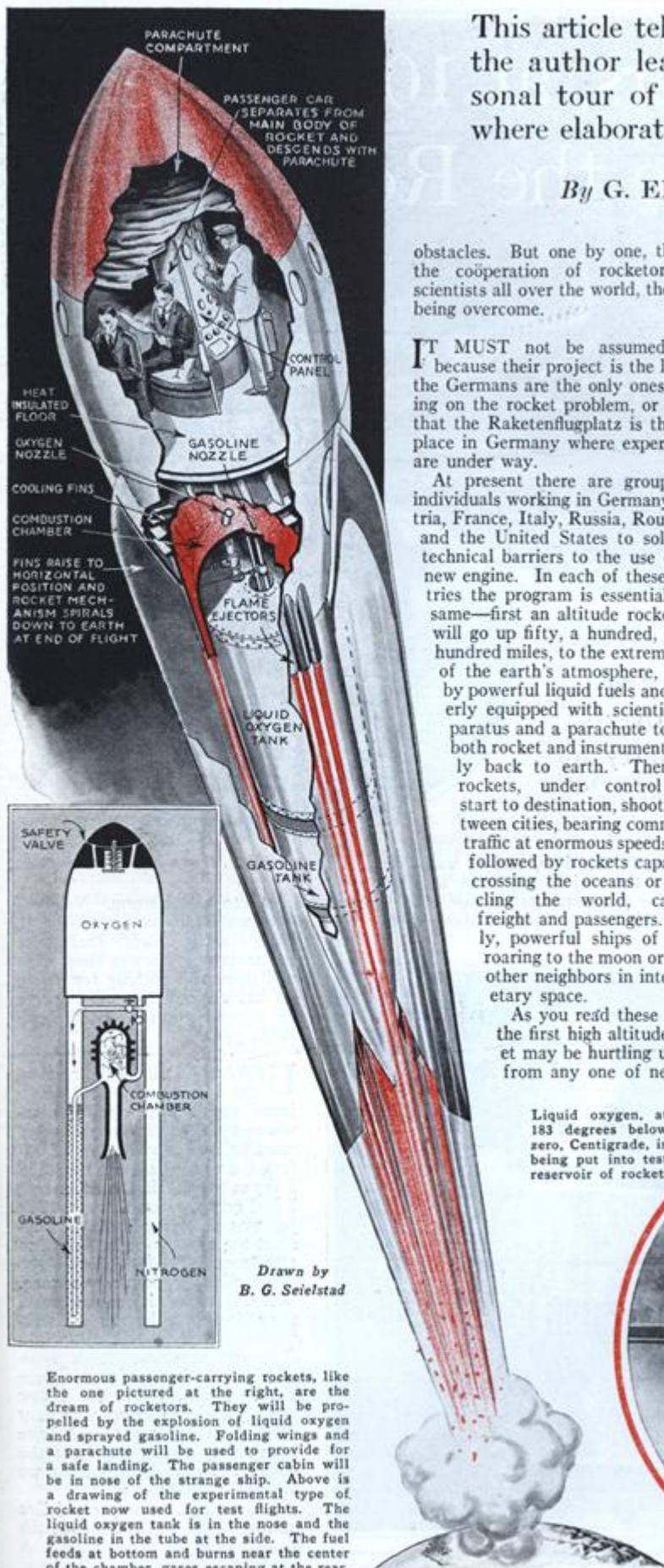
score of experimental stations here and abroad, penetrating into that borderline between atmosphere and space that no instrument made by man has so far touched. When that has been accomplished we may look for the rapid development of rocket traffic, for the greatest problem is that of applying tremendously powerful liquid fuels in such a way as to get the full energy without bursting the rocket.

The fuel at present being experimented with by the Germans consists of liquid oxygen and gasoline. The oxygen is necessary because the combustion is so rapid that it could not be supported by the oxygen of the air. The handling of the oxygen is one of the chief difficulties. To keep it liquefied it must be maintained at a temperature colder than 183 degrees below zero, Centigrade. At this temperature even mercury is frozen, and special, elaborate containers must be used to handle the liquid.

ABOVE this temperature the oxygen boils furiously, giving off quantities of oxygen gas. If the container is closed to prevent free evaporation a tremendous pressure is created almost instantly, and if no provision is made to relieve it, the container will burst with a terrific explosion.

During the rocket's flight the oxygen fuel must be kept cold, yet under sufficient pressure to force it rapidly into the combustion chamber, which is the motor of the rocket. There, not many inches from the extreme cold of the oxygen, a temperature as great as that of the oxy-acetylene flame exists, fed by continuous streams of gasoline and oxygen.

A most important problem, and one that has not been (Continued on page 120)



Drawn by
B. G. Seielstad

Enormous passenger-carrying rockets, like the one pictured at the right, are the dream of rocketors. They will be propelled by the explosion of liquid oxygen and sprayed gasoline. Folding wings and a parachute will be used to provide for a safe landing. The passenger cabin will be in nose of the strange ship. Above is a drawing of the experimental type of rocket now used for test flights. The liquid oxygen tank is in the nose and the gasoline in the tube at the side. The fuel feeds at bottom and burns near the center of the chamber, gases escaping at the rear.

Liquid oxygen, at 183 degrees below zero, Centigrade, is being put into test reservoir of rocket.



Exploring the MOON



A scene from the UFA motion picture, "The Girl in the Moon," which gives a scientifically accurate view of the Moon's surface.



M. Robert Esnault-Pelterie, French scientist and author of this interesting article.

Alexander the Great wept because he had no more worlds to conquer, but the modern scientist is more optimistic and plans to conquer worlds situated millions of miles from the earth. In this article a famous French experimenter tells of his problems in building a moon-rocket ship.

Editor's Note: After 25 years of investigation in aeronautics and astronautics, Esnault-Pelterie has worked out a systematic plan of procedure for making a flight to the moon. He first plans to build a rocket, containing only scientific instruments, that will travel 100 miles into the air, descending by parachute and bring back data of the stratosphere. This he believes will be done in two years.

Then he plans to construct mail rockets for European and later trans-Atlantic service. These mail rockets at first will not carry passengers but this will come when the pilotless ships have attained perfection. From the experience thus gained he believes that a successful interplanetary rocket can be constructed. He explains his problems and how he hopes to overcome them, in this article.

THE first question that comes to mind is—what is the interplanetary problem?

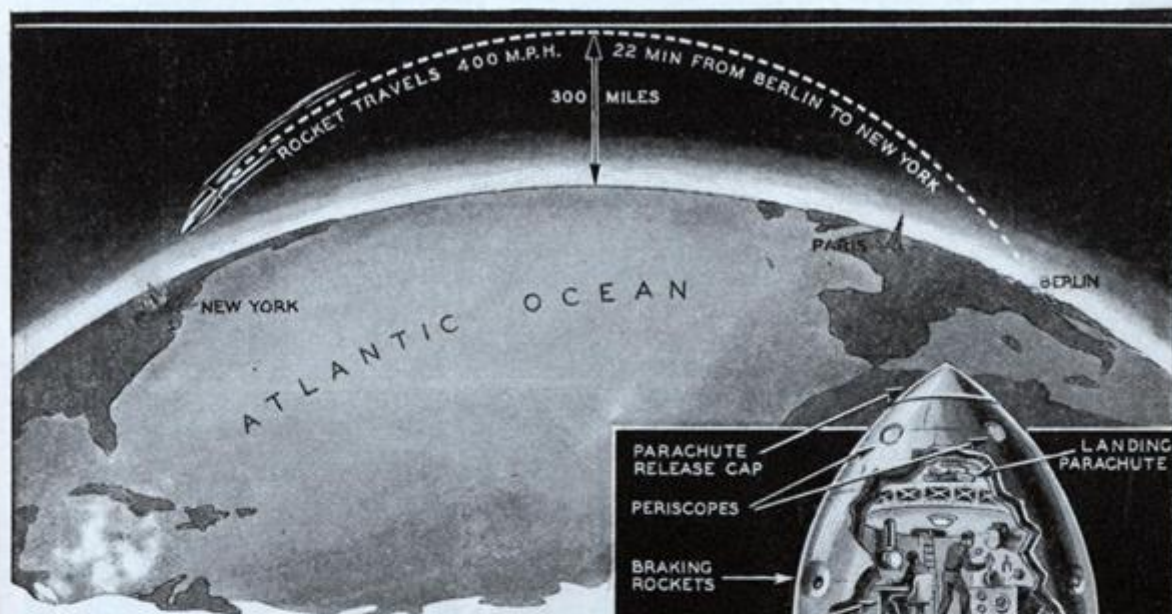
I think we can understand the answer to this question best when we picture our position in the universe. We live upon a little speck of dust called the Earth. About 92,000,000 miles away is the Sun that warms us and keeps us alive. The Earth continually moves around the Sun in an orbit that takes 365 days to complete. Moving with it, in other orbits, are the other planets, Mercury, Venus, Mars, et cetera.

The Earth, in addition to being a satellite of the Sun, has a satellite of its own, the Moon, which circles about us continually at a distance of about 240,000 miles, completing its revolution every 28 days. It is this Moon that is to be the outer terminus of the first interplanetary journey.

There is a property possessed in common

by Rocket SHIP

by ROBERT
ESNAULT-PELTERIE
as told to ALFRED ALBELLI



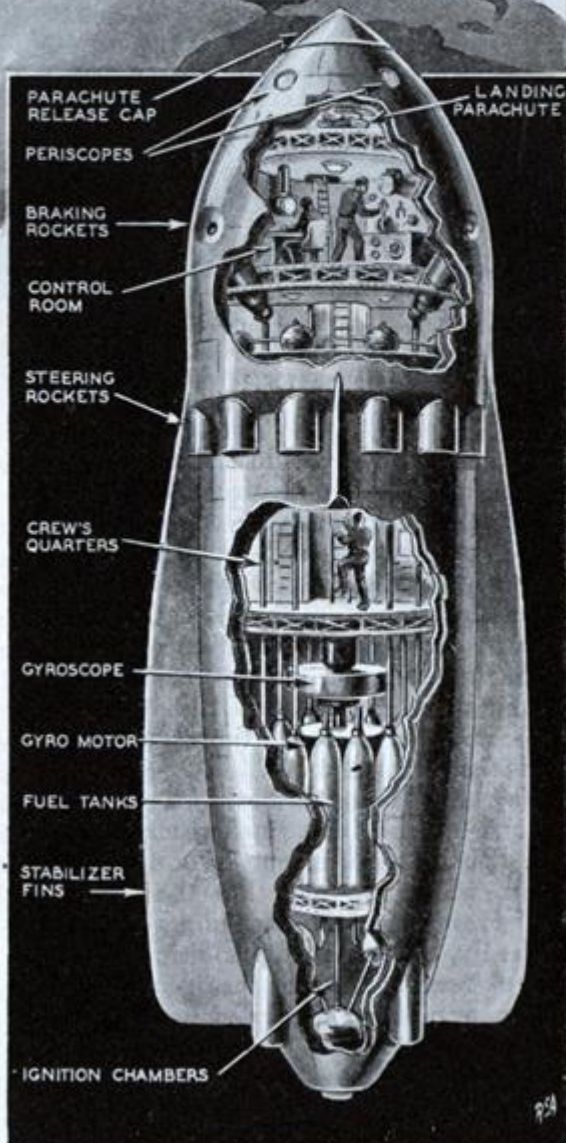
According to G. Edward Pendray, vice president of the American Inter-planetary Society, mail will be sent by rocket from Berlin to New York City in twenty-two minutes in the near future, reaching a height of 300 miles at the top of its arc.

by all these bits of dust, and that is gravitation. The planets are held in their orbits around the Sun, the Moon is held in its path, and even more important to us at this moment, we are held close to the Earth by this force.

In order to escape from the Earth to reach the Moon we must be able to oppose that force of gravity and lift ourselves against it for the distance of 240,000 miles. Surely this is a gigantic task. For consider—the airplane has been able to climb only eight miles above the surface of the Earth. The balloon, without passengers, has reached an altitude of only 22 miles.

Fortunately this force of gravity will let go if we pull against it hard enough. As we draw away from the Earth the force does not remain the same. It diminishes according to the square of the distance. This is a fact that will be of great help to us. It means, for example, that if I were out in space 4,000 miles from the surface of the Earth, the pull upon me would be only one-fourth that of the Earth's surface. If I were 50,000 miles away from the Earth, I would weigh only one pound.

From that point on, as I neared the



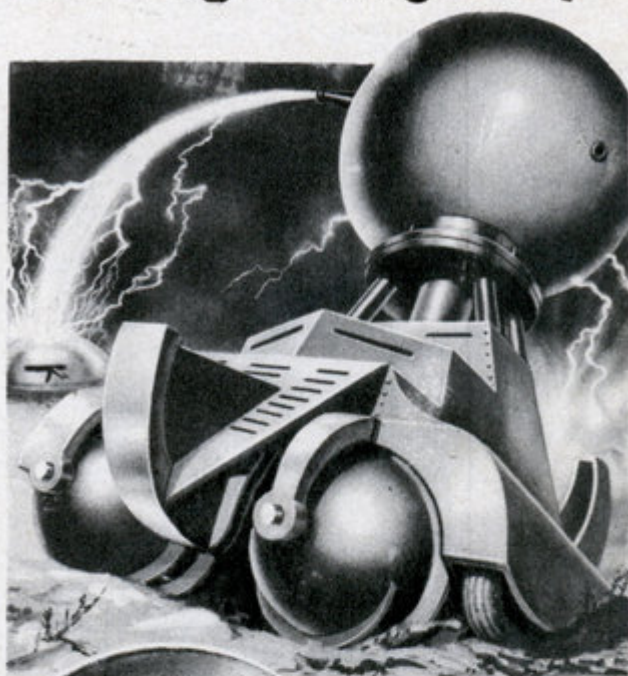
Artist's conception of an interplanetary rocket drawn from the descriptions of various experimenters is shown above. The ship will be propelled by special liquid gas and a gyroscope will prevent it from deviating from its proper course.

Electro-Tank Shoots Lightning Rays

LIGHTNING, enemy of man for countless centuries, may become his deadliest weapon of war. Combining the Van deGraff lightning generator with the newest high speed war tank, a design has been suggested for an electro-ray tank which promises to revolutionize offensive warfare.

The gunner of this lightning-generating tank, seated at the control desk inside the massive metal sphere, can direct at enemy troops a small but extremely powerful stream of water, as the screw-driven vehicle rumbles forward at high speed. Along this conducting stream artificial lightning from the hundred-million volt charged sphere would crackle ominously, delivering instant death to all living creatures sprayed by the water.

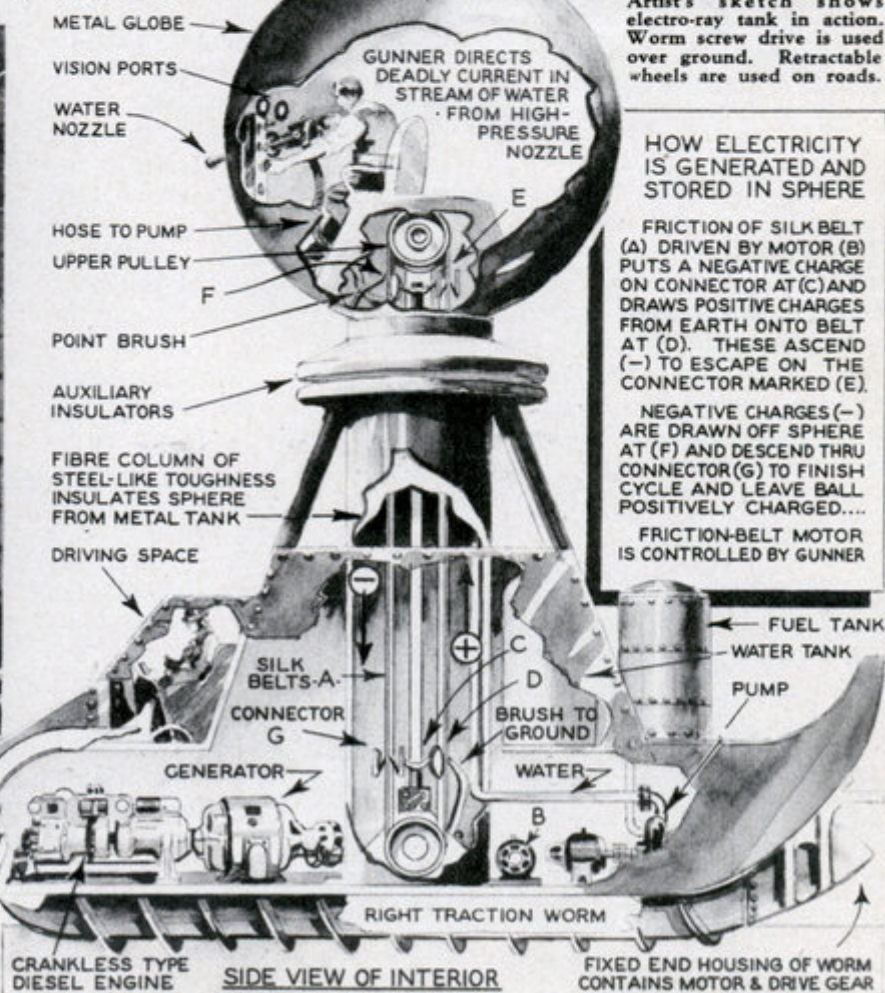
Inside the heavily armored tank other men would supervise the gigantic crankless Diesel which drives the power generator to supply current for electric motors.



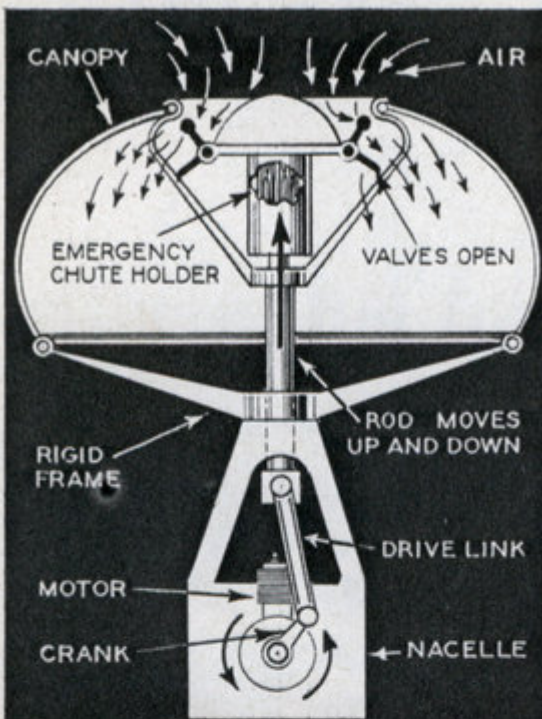
Artist's sketch shows electro-ray tank in action. Worm screw drive is used over ground. Retractable wheels are used on roads.



Pictured above is a 7,000,000-volt lightning generator, built for scientists at Massachusetts Institute of Technology; Dr. Robert J. Van deGraff of Princeton University is inventor. At right are details of electro-ray tank, newest war machine.

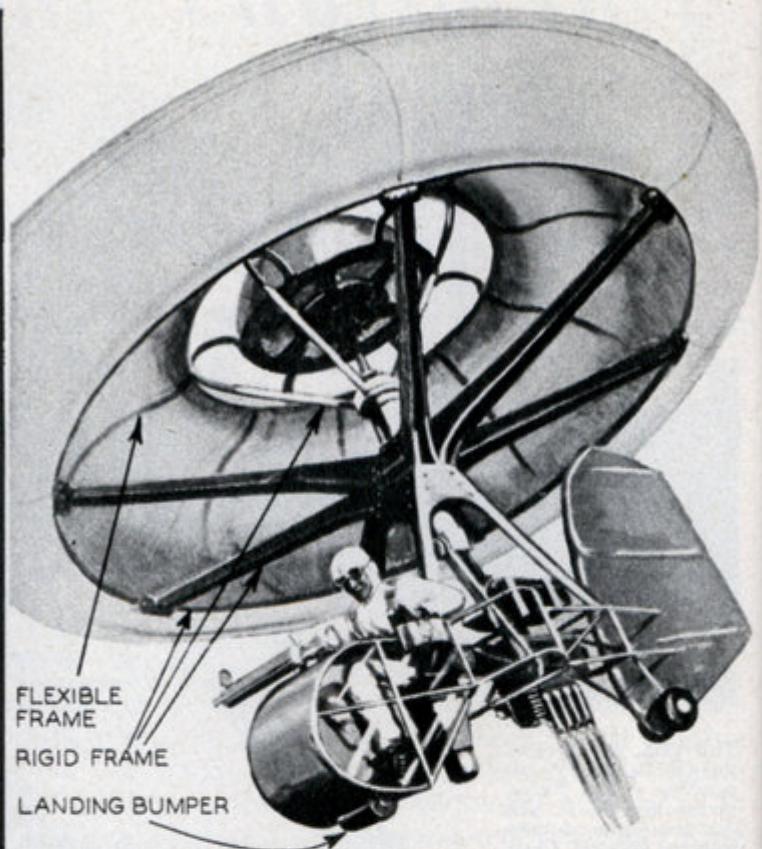


Artillery Spotter Has Vertical Lift



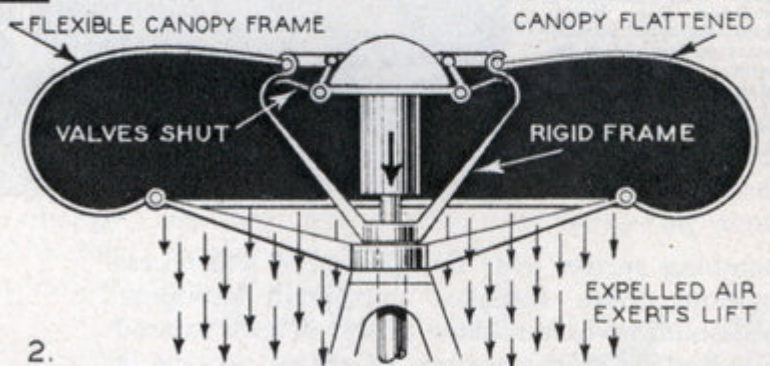
OPERATING PRINCIPLE EXPLAINED

1. SUCTION STROKE - CRANK EXTENDS CANOPY - VALVES OPEN TO ADMIT AIR -



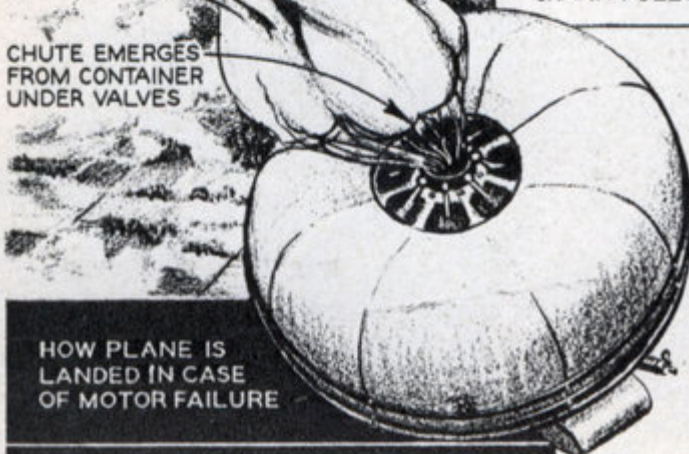
VALVE CAP OR FAIRING ACTS AS PILOT CHUTE TO RELEASE EMERGENCY PARACHUTE

CHUTE EMERGES FROM CONTAINER UNDER VALVES



2.

OPERATING PRINCIPLE EXPLAINED — POWER STROKE
CRANK PULLS CANOPY DOWN COMpressing & EXPELLING AIR



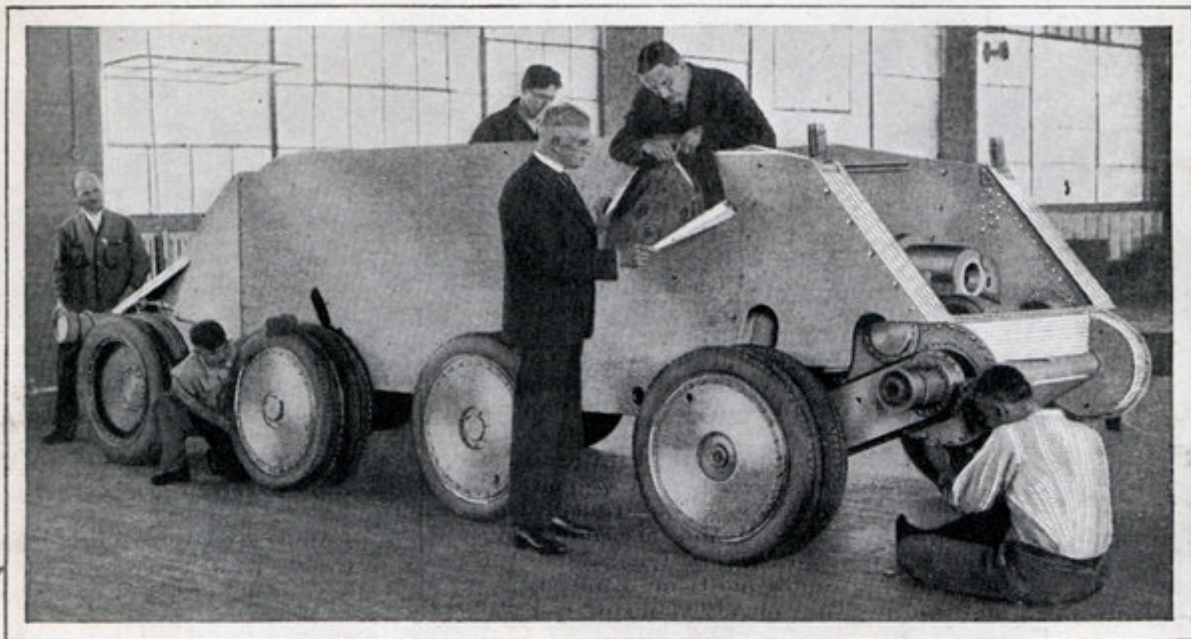
HOW PLANE IS LANDED IN CASE OF MOTOR FAILURE

Pulsating through the skies in much the same manner as employed by the jellyfish in propelling itself through water, a weird parachute artillery spotter is expected by its inventor, John A. Domenjot of New York City, to supersede the ordinary kite-balloon in observation work during war.

Greater maneuverability with resultant greater safety for the pilot, economy, and the elimination of ground crews are among the advantages claimed for this type of craft.

The parachute artillery spotter consists of a flexible canopy mounted on rigid annular frames, the upper portion being capable of an up and down motion which is obtained by means of a crank and piston rod. Driving power for the piston is supplied by a moderate sized gasoline engine. A complicated set of valves centered about a circular aperture in the top of the canopy controls the air pressure exerted with the descending stroke. In an emergency a parachute will lower the craft safely.

FLYING TANKS that



Here is the fuselage or body of the flying tank under construction. It is surprisingly light in weight, thanks to methods of construction which are jealously guarded. J. Walter Christie, noted builder of army tanks, is the man inside the body who is pointing to the plans. Caterpillar treads can be fitted over the wheels, to be used when necessary.

Imagine those two formidable weapons of modern warfare, the airplane and the armored tank, combined into one terrible machine of destruction! Fantastic as the idea sounds, it is fast taking physical shape as a reality for Uncle Sam's army. The whole amazing story is presented to you in this important article.

IS WAR, already made terrible to contemplate by the invention of too-efficient methods of destruction, on the verge of being banished forever by an amazing new weapon so horrible in its possibilities that nations of the world will not dare to risk its fury?

This is the idea conjured up by J. Walter Christie, noted builder of tanks for the U. S. Army, who has been secretly working on the most revolutionary war invention since the discovery of gunpowder—an armored tank which flies as swiftly as a bombing plane, and which, by simply shedding its wings when on the ground, can travel over any terrain with guns blazing at speeds of 70 miles an hour!

Changes Modern War Strategy

The entire strategy of modern warfare will have to be altered when Mr. Christie's flying tank is proved practical. Trench warfare, which played such an important part in the World War, will be well-nigh impossible, for with a swarm of a hundred flying tanks descending into No-Man's Land, no infantry in the world could resist the withering fire.

Nor is the flying tank so grotesque an idea as might appear at first glance. During the late war no one even conceived the possibility of an armored tank's being propelled through the skies on wings like an airplane, driven by an airplane motor.

Flying Tank Now Being Built

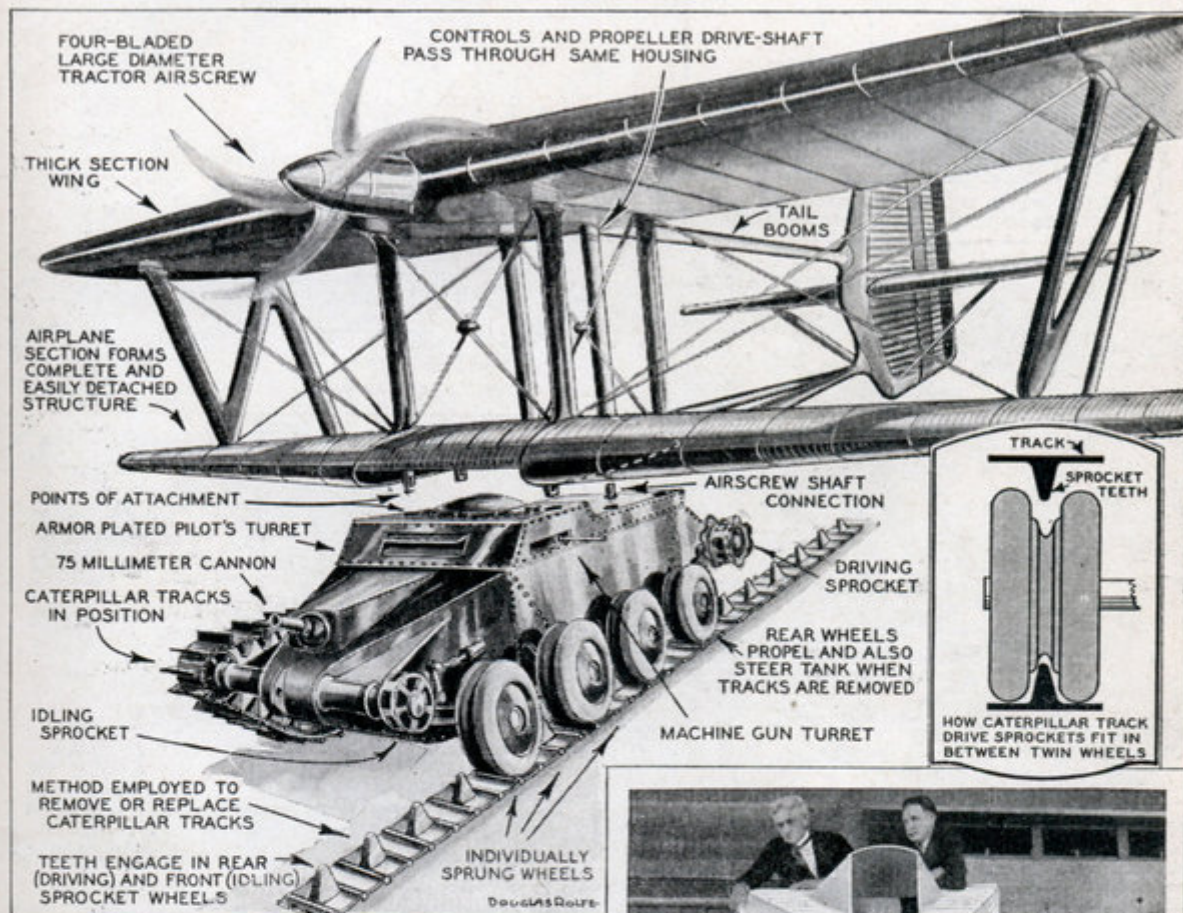
Yet Mr. Christie's tank, he promises, will do precisely that. Because of his success in building speed tanks for the army and his extensive knowledge of this phase of warfare, there can be no doubt that he knows just what he is doing. He is not a man given to exaggeration, and the fact that the tank is now taking shape in the plant of the United States Wheel Track Layer Corp., at Linden, N. J., proves that the idea has advanced beyond the paper and plan stage.

In the words of the inventor, "The flying tank is a machine to end war. Knowledge of its existence and possession will be a greater guarantee of peace than all the treaties that human ingenuity can concoct. A flock of flying tanks set loose on an enemy and any war is brought to an abrupt finish."

Details of the tank's construction are

Modern Mechanics and

Shed Their Wings! by LEW HOLT



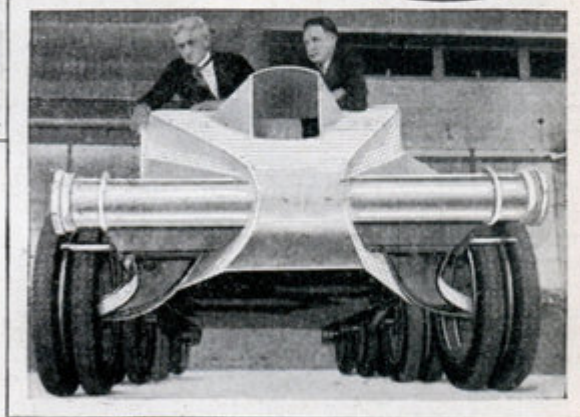
This drawing gives details of the flying tank's construction. Note how the flying structure can be shed at will, leaving the tank unit fully equipped for combat and capable of traveling 70 to 100 miles an hour, depending on terrain.

astonishing. The flying fortress will be armed with a 75 millimeter gun, with supplementary small machine guns. Personnel will consist of two men. The body of the flying tank is amazingly light because of new principles of construction closely guarded by the inventor. In fact, the finished product, ready for military duty, will not weigh over four tons.

Its lightweight engine can develop 1000 horsepower, and by an ingenious system of gearing the motor drives both the back axle, for propelling the tank on the ground, and the propeller for flying duty.

Take-off Problem Solved

Eight large wheels are provided on the tank, with twin pneumatic tires over which the caterpillar tread fits. With the special springing equipment, pneumatic tires and patented caterpillar track, Mr. Christie's tank can make 70 miles an hour across rough country, it has been calculated, and as much as 100 miles an hour on a smooth surface. Its speed makes it a difficult target for enemy fire.

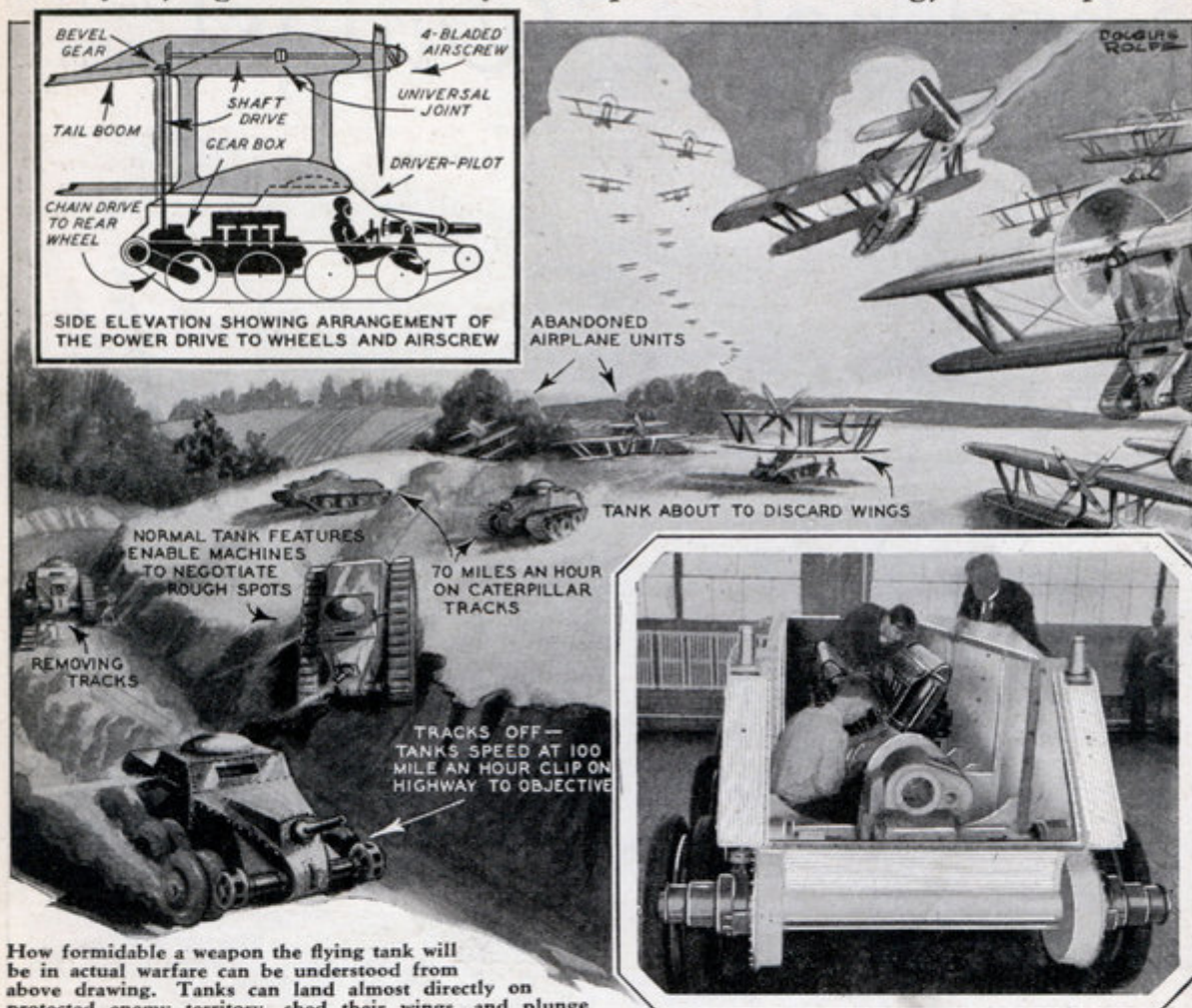


Front view of the tank. Caterpillar treads can be attached to the wheels, as diagrammed above, or the machine can proceed on its eight twin-tired wheels.

"It is an established fact that a single pair of wings can support this tank in the air," Mr. Christie explained to the special representative of MODERN MECHANICS AND INVENTIONS. "Any aviator can tell you in two minutes the exact wing spread required."

"The most serious difficulty seems to be the take-off. Several of my flying friends have told me that many army planes require three-quarters of a mile of prepared ground for a runway and they insisted that my machine would need a still greater starting space. There were also those who doubted that my tank would even leave the ground."

Use of Flying Tanks in Warfare Requires New Strategy Developments



How formidable a weapon the flying tank will be in actual warfare can be understood from above drawing. Tanks can land almost directly on protected enemy territory, shed their wings, and plunge into action with 75 millimeter guns blazing destruction.

"After three years of experimentation, I was prepared to meet their queries and their doubts. This is the solution: My machine will work up to a flying speed while it is still on the ground. At a hundred yards the tank will be going fast enough to rise the moment the power is transferred from the wheels to the propeller, no matter on what kind of surface the tank is traveling.

"The caterpillars will function on any condition of base. The Christie speed tank which has been already acquired by the United States government bears testimony to that advantage.

Treads Simplify Landing Problem

"The other hazardous stumbling-block, the landing of the flying tank, has also been overcome. My machine can alight on very limited space. The pilot can observe his air speed by means of his instrument board. When he switches from being a pilot to being a chauffeur he will know his land speed, both on the caterpillar tracks and on wheels, whichever he may choose to bring into use.

"All that the man at the controls has to do is to start the wheels of the caterpillar in motion and adjust them to the air speed.

View of motor installation in the flying tank, looking from the rear. Note the transmission unit in the foreground for carrying power to propeller in the wings. Two shafts for securing the tank to the wing units can also be observed on the top of either side of the body.

This is done merely by keeping an eye on the speedometers. As soon as the tank touches the ground, he brakes it as he would an auto truck.

"If he wants to liberate the tank from the wings, he has only to press a lever and that operation is completed in a jiffy. Then if he wants to, he can proceed along a highway on the rubber-tired wheels at a rate of 100 miles an hour."

That is how Mr. Christie's latest invention will work. But he has already begun to plan for a further improvement on this device. He will soon begin work on a detachable airplane as applied to the armored tank. The plane will deposit the tank at a desired post and then return to bring up others, or engage in other maneuvers.

In connection with these latest experiments, a valuable peacetime use of the flying tank principle suggests itself.

One of the several problems confronting passenger air lines today and, from the passengers' standpoint, certainly the most annoying, is the business of getting passengers to and from the airport—the actual

Flying Tank Principle Can Be Adapted to Speed Up Airplane Travel

point of arrival and departure of the airplane itself.

Airports are perforce located at a considerable distance from the downtown district of a city and it naturally follows that the larger the city the more inaccessible will be the airport or air terminal. In the minds of prospective air passengers the immediate accessibility of bus and railroad facilities contrast pleasantly with the annoyance attendant on purchasing a ticket, riding out to a field, transferring to a plane and repeating the performance at the flight destination.

The time-saving feature, most practical appeal of air travel, is thus not so much in evidence or even may be totally absent in flights of less than 300 miles.

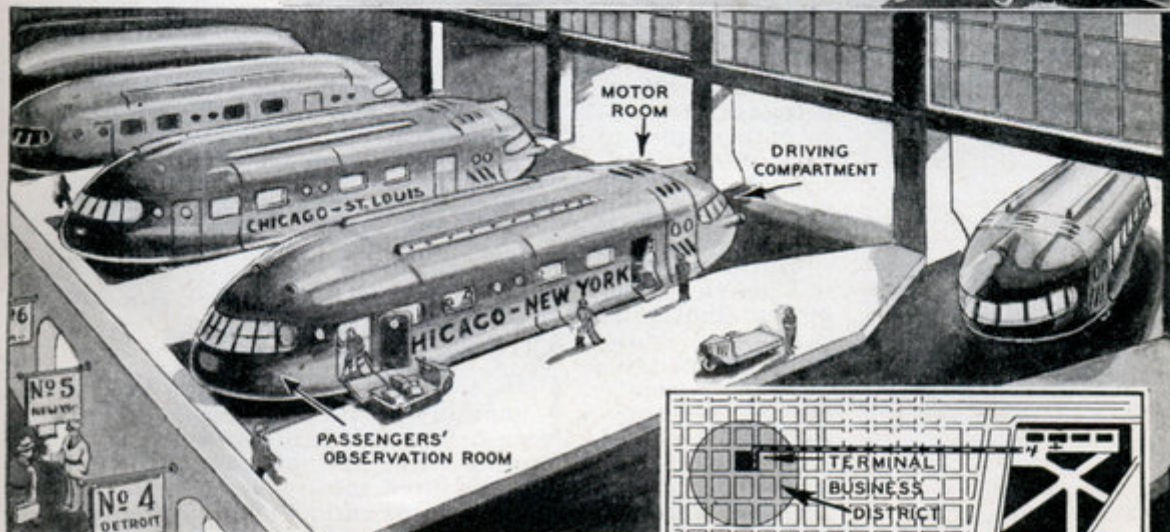
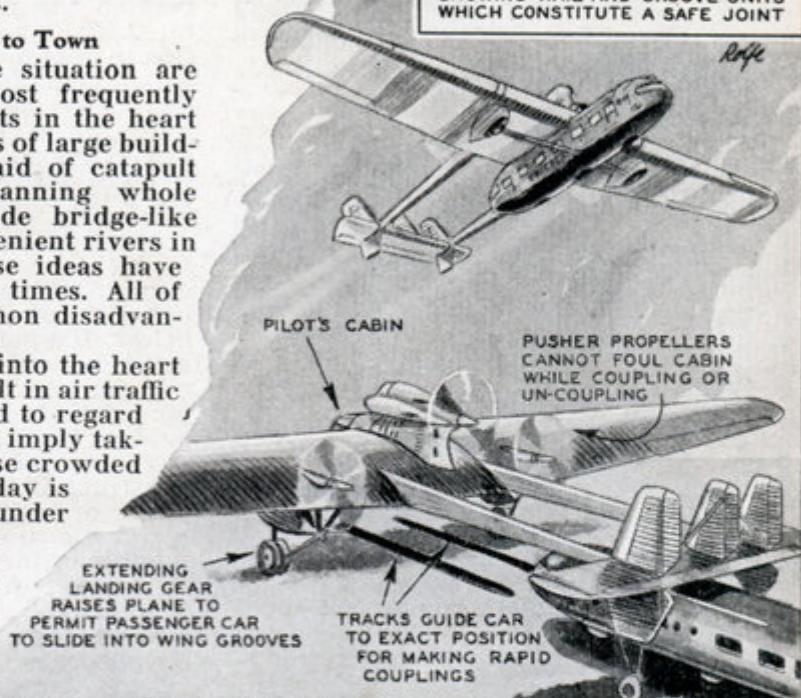
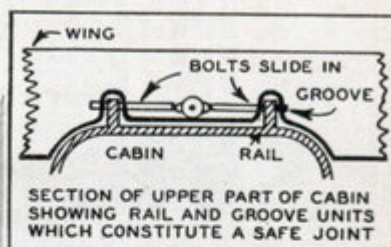
Bringing Airports Close to Town

Several remedies for the situation are feasible. One, and the most frequently heard of, is to build airports in the heart of a city, by utilizing the tops of large buildings with or without the aid of catapult launching devices, by spanning whole blocks of streets with wide bridge-like structures or spanning convenient rivers in a similar manner. All these ideas have been mentioned at different times. All of them suffer from one common disadvantage.

To bring an air terminal into the heart of a city would not only result in air traffic at an altitude we are obliged to regard as unsafe, but would further imply taking off and landing over these crowded centers. The airplane of today is hardly suited to operating under the conditions just outlined and therefore this otherwise attractive solution of the problem must, for the time being at any rate, be abandoned as a serious consideration.

Another course is open and fantastic as it may appear at first glance the idea has been approached a number of times and there are no serious difficulties in the way. The idea involves the building of passenger planes in two distinct and self-contained units. One, the airplane portion, would

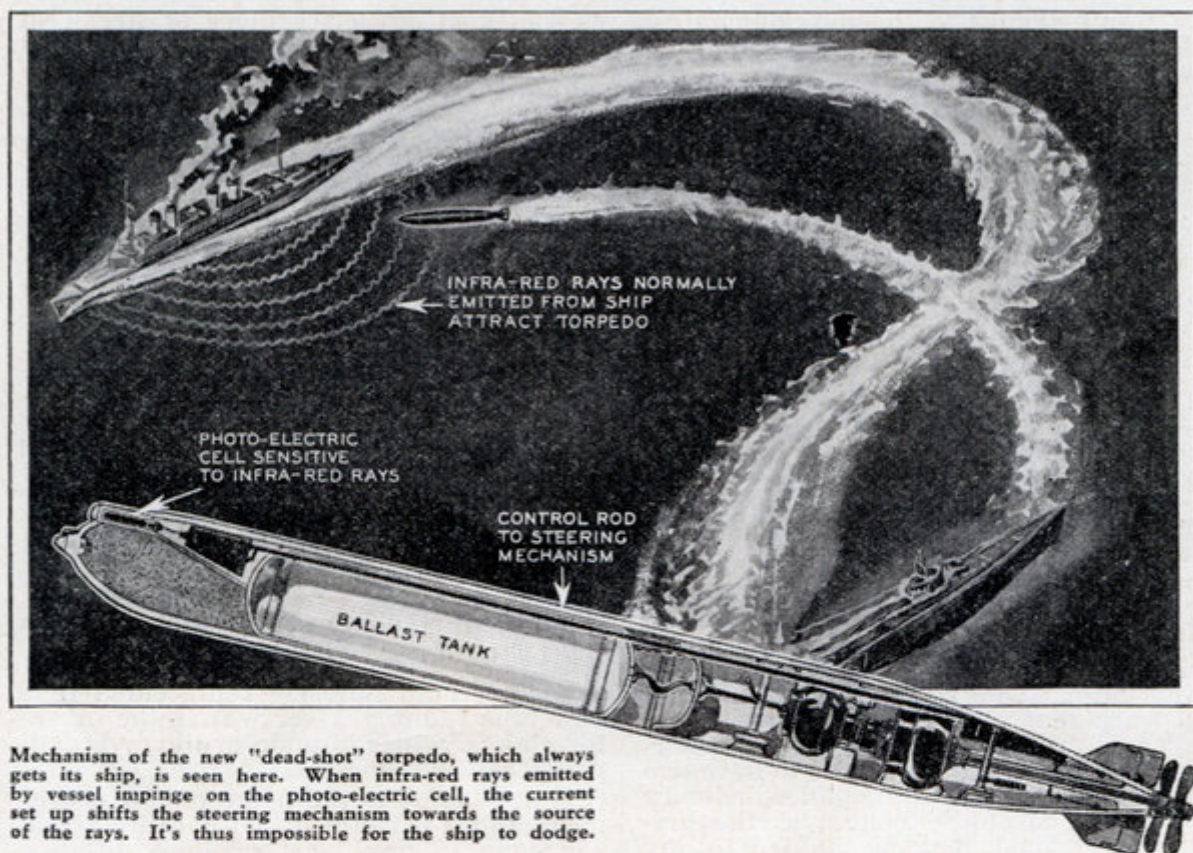
(Cont'd on page 170)



The flying tank idea can easily be adapted to commercial use, as illustrated in this drawing by Douglas Roffe. Detachable cars can pick up passengers in the city's center, drive to the airport, and there be fastened to flying units.

SHOWING THE CENTRAL LOCATION OF MAIN AIR TERMINAL MADE POSSIBLE BY AIR CARS

World's Deadliest Weapons



Mechanism of the new "dead-shot" torpedo, which always gets its ship, is seen here. When infra-red rays emitted by vessel impinge on the photo-electric cell, the current set up shifts the steering mechanism towards the source of the rays. It's thus impossible for the ship to dodge.

While peace parleys convene, only to end in failure and increased hatreds, military inventors smile to themselves and go on perfecting their engines of death. This article sets forth advanced data on these new weapons and tells how they will add deadliness to combat when they appear at the Front in next war.

by RUSSELL J. MORT

FROM the bow of a submarine lurking submerged in the offing shoots a torpedo bound on a mission of destruction. Leaving a streaked wake as it cleaves the water, it speeds straight for the hull of an unwary destroyer cruising across the horizon.

In the crow's nest of the destroyer, the lookout scanning the sea's surface for any sign of an enemy, picks up the white foaming line whose point is tearing towards his vessel. Without a moment's hesitation he shouts the ominous warning into the speaking tube leading to the bridge: "Torpedo off the starboard beam!"

Hard A'port to Avoid Torpedo

With cool haste the destroyer's commander signals the helmsman to put the wheel hard a'port. Then while the long, deadly torpedo dashes ahead, the lean, gray destroyer swings sharply to the left, and the commander breathes a sigh of re-

lief, for he believes he has maneuvered around in time to get out of the path of the onrushing missile.

But suddenly and unaccountably the torpedo alters its course, too, and makes a bee-line straight for the destroyer's hull. The ship's commander is bewildered at these strange antics. Again he signals hard a'port. The vessel swings around again, and again the torpedo, now only a hundred yards off, changes its course—straight toward the war dog's hull.

No Escape

The commander shouts orders for the third swing to port, but it's too late. The torpedo dashes against the destroyer's side and there is an ear-splitting detonation. Like some inescapable undersea Nemesis, the submarine's missile has hunted down its victim and sent it to the bottom of the sea.

Thus may naval encounters of the fu-

Will WAGE NEXT WAR

ture result, thanks to the development of a new type of torpedo which will literally chase its victim around the ocean till it finds its mark.

Complete details of the amazing torpedo are veiled in secrecy. However, sufficient information has been released by its inventors to give a fairly clear idea as to the operation of its mechanical steering brain.

Infra-red Rays Steer Torpedo

The secret of the steering mechanism lies in the electric eye built into the nose, just beside the detonating cap, as illustrated in an accompanying drawing. Special filters mounted in front of the "eye" screen out all but infra-red rays, that is, the invisible heat rays at the lower end of the light spectrum.

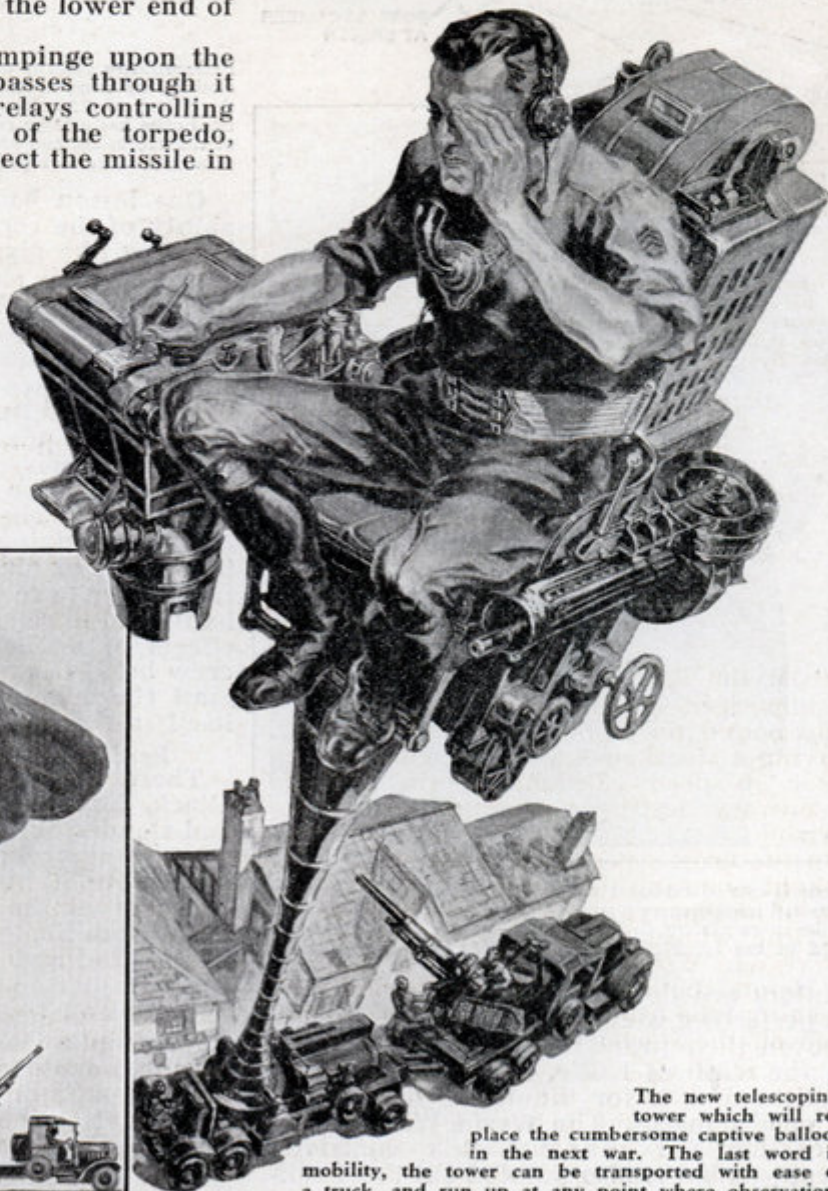
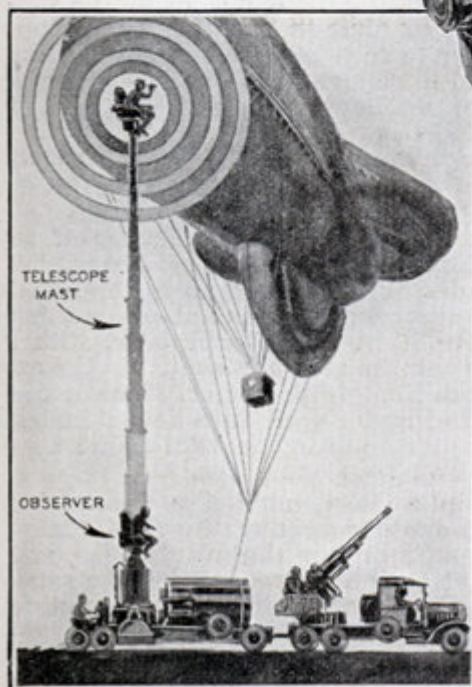
When infra-red rays impinge upon the electric eye, a current passes through it which operates a set of relays controlling the steering mechanism of the torpedo, shifting the rudder to direct the missile in the direction from which the infra-red rays emanate.

Now most all bodies which radiate heat radiate infra-red rays, heat and infra-red rays being practically the same thing. A naval vessel radiates a slight degree of heat from its engines and it is these infra-red rays which attract the torpedo to the vessel's hull, much

as a magnet attracts a piece of steel. No matter what maneuvers the ship may go through, the torpedo, speeding towards the source of the infra-red rays, will always strike its target.

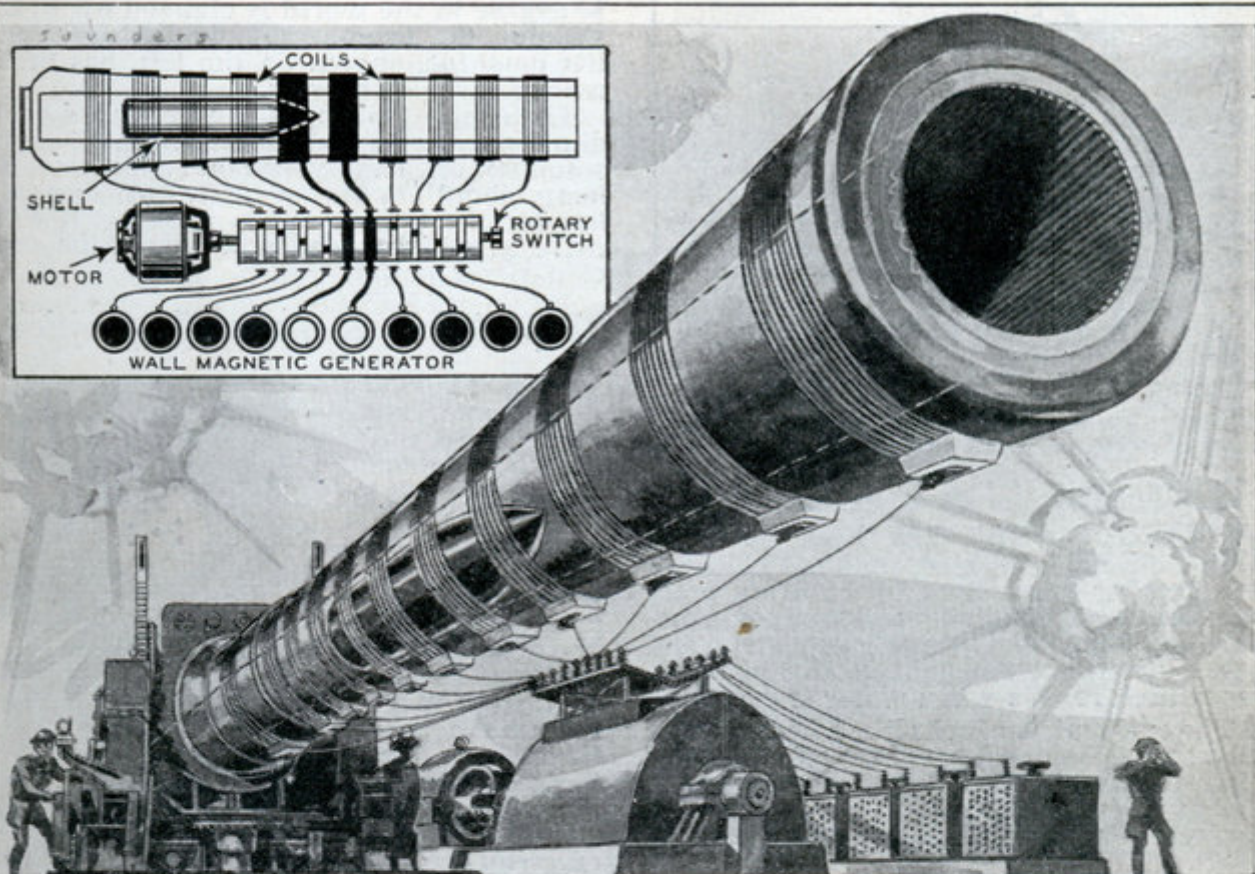
One of a number of new instruments of war, the invention of this new engine of death points out a distinct trend in the development of weapons for future wars. There is much wild talk among laymen in military matters about weapons so hideous that in battles in the next war whole regiments will be annihilated in the batting of an eye.

Thorough research on the part of MODERN MECHANIX AND INVENTIONS correspondents, however, indicates that military in-



The new telescoping tower which will replace the cumbersome captive balloon in the next war. The last word in mobility, the tower can be transported with ease of a truck, and run up at any point where observations must be made of enemy movements and artillery fire. Tower rises 200 feet at push of button.

ELECTRIC Cannon Uses No Gunpowder



The magnetic gun, pictured on this month's cover, is foreshadowed by achievements of two English experimenters. Powerful currents working through coils around the gun barrel exert a magnetic effect on the steel shell, pulling it through the barrel at tremendous speed. Each coil has its own generator, and the shell advancing through the barrel will automatically energize the coil just ahead of it. A rotary switch could be employed to adapt the idea to machine guns.

SILENT guns sending their whistling messengers of death into the sky at speeds far beyond those now attained by powder-driven shells seem likely for the next war, using for propulsion magnetic fields so powerful that when they are short-circuited they produce miniature earthquakes.

Dr. Kapitza, F. R. S., working at the Cavendish laboratory of Cambridge University, England, in his attempts to disrupt the atom has produced magnetic fields so powerful that they "explode" the coils that produce them. This man has finally revealed the secret of the magnetic gun so long anticipated by ballistic experts. Dr. Kapitza accomplishes the electric firing of a shell by short-circuiting powerful dynamos for periods of one one-hundredth of a second.

Another English experimenter, Dr. Wall, seeking the same thing, produces ultra-magnetic fields with a more simple apparatus. Dr. Wall simply charges electrostatic condensers and permits them to discharge their powerful currents into specially made coils immersed in oil baths. Here also magnetic fields so powerful that they tear the coils to pieces have been produced. So great are these magnetic fields that they are capable of pulling iron nails out of shoes.

While the magnetic effects produced by

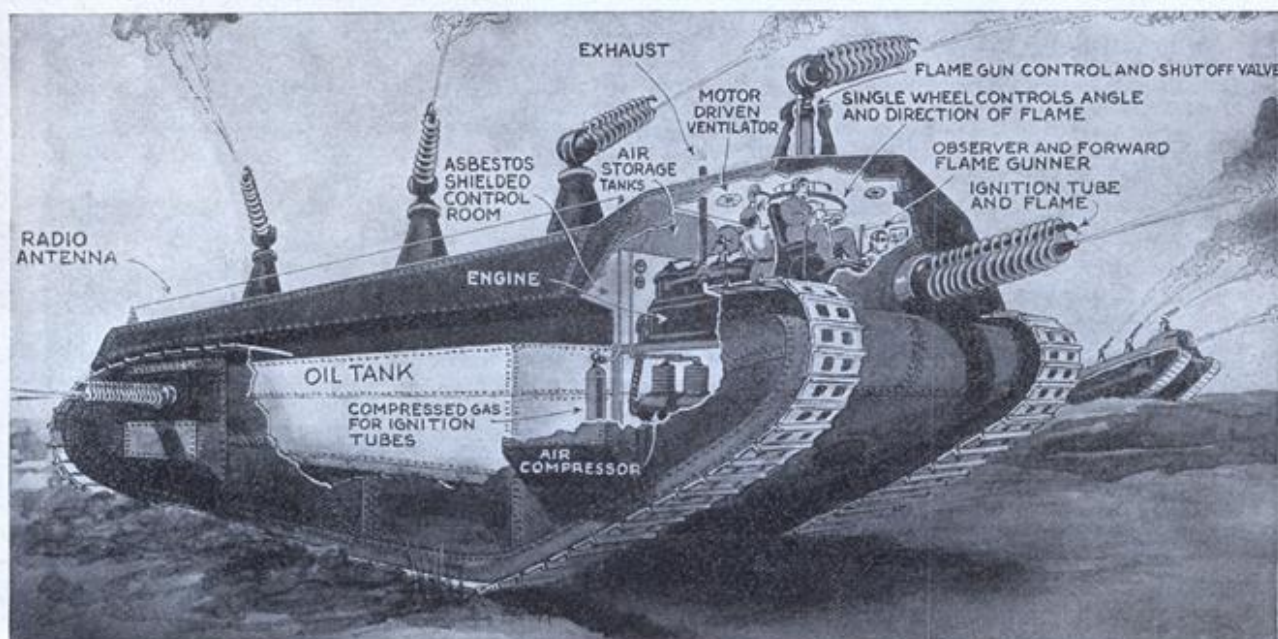
both of these experimenters are of very short duration, they could be employed to impart their terrible energy to steel shells. The time limit, which cannot exceed one one-hundredth of a second, is imposed because of the powerful currents used. If these currents were permitted to flow through wire for a greater period of time, the wire would melt and temperatures greater than those existing in some of the hottest stars would be produced.

To produce a magnetic gun—a silent Big-Bertha—it will only be necessary to arrange a series of powerful coils within the gun barrel. Each coil will have its own generator and the shell advancing through the barrel will automatically energize the coil just ahead of it. By the time the shell reaches the end of the barrel it will have attained a speed far in excess of the speeds now attainable with even the highest explosives known.

Owing to the entire absence of internal pressures these guns may be made of ordinary iron or even of purely non-magnetic materials. The "magnetic explosions" will be initiated by the simple closing of a switch which will energize the first coil and snatch the shell from the breech in the first leg of its journey of destruction.

The Flame Tank

By HUGO
GERNSBACK



Cut-away view, showing the interior arrangement of the flame tank, a proposed new engine of war, but useful also in the arts of peace, when necessary to clear large areas of ground. The flaming liquid can be thrown to great distances, under control of the operating crew.



The stream of liquid flame thrown from a one-man portable flammenwerfer during a test. Observe figure at right.



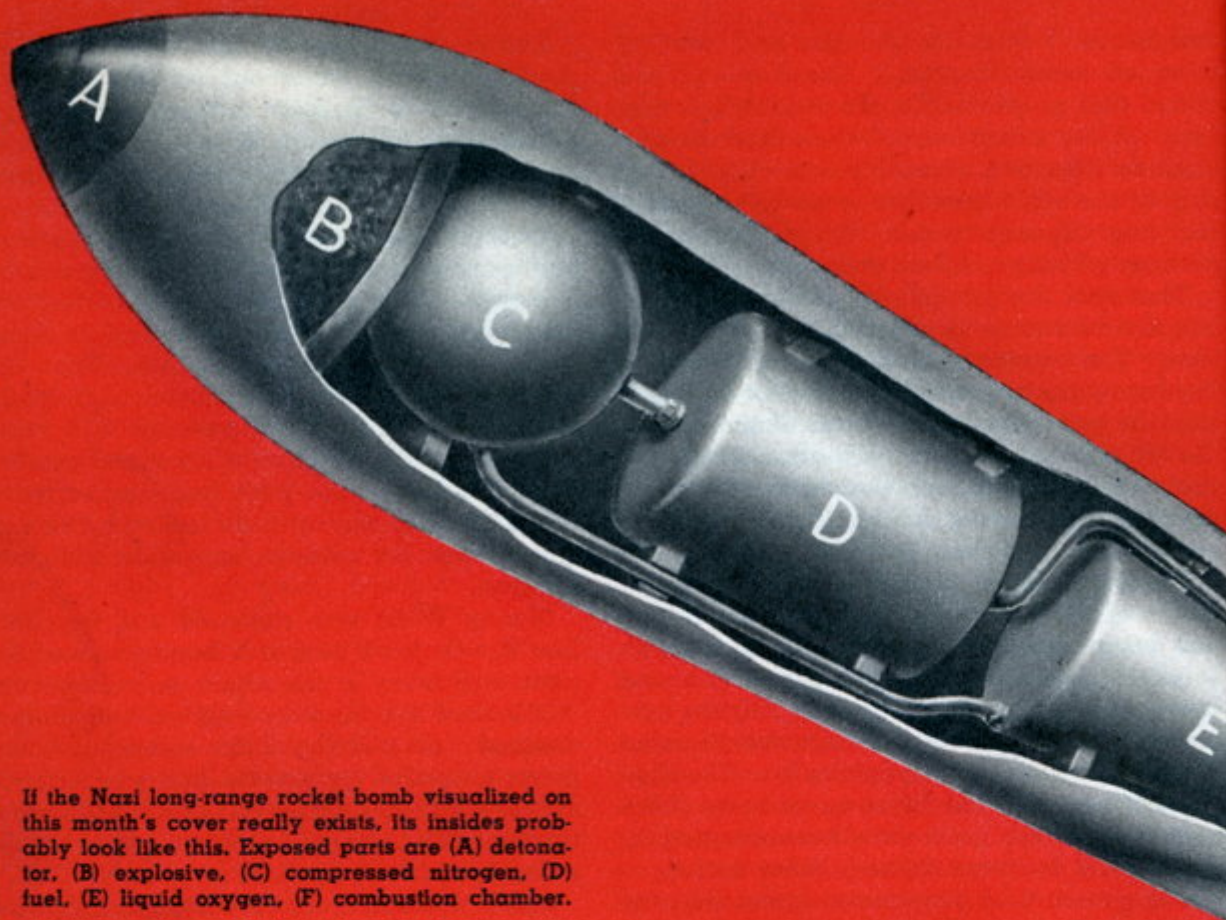
Italian flame throwing unit in fireproof suits, with their tanks and nozzles.

● LAYMEN still labor under the erroneous conception that war is far more frightful in modern times, and that it kills more of the combatants than formerly. Quite the contrary is true. In ancient war, when hand-to-hand fighting was the order of the day, as, for instance, in the old Roman times, casualties were far and away greater than they are in modern warfare. Close fighting with swords and other hand operated weapons wrought terrific havoc. Not only that, but, even if a soldier were only slightly wounded, he often died of infection. In other words, even if you weren't killed outright, and were only slightly wounded, the chances

were all against your recovery. The reason for this is that, in the old days, there was no such thing as an organized Red Cross movement or even intelligent medical care of the wounded.

In modern war, where armies fight further and further apart, war becomes less brutal, and the wounded have a better chance of recovery. Of course, there is still close fighting at times but, in general, it happens only occasionally and is not the general order of the day. Modern war tactics demand mobility of the opposing factions, and they often do not get within miles of each other. Only when the enemy digs itself in, with earthworks and trenches, does close fighting again become necessary. If means are found to threaten the extermination of the men in the trenches, it will be found that they quickly abandon the trenches as untenable. This means that much less slaughter will be required; because the enemy will retire when he knows the odds are overwhelmingly against his holding his position.

The flame tank, which I present herewith as a new idea in warfare, is not—as it would appear on first
(Cont. on page 34)



If the Nazi long-range rocket bomb visualized on this month's cover really exists, its insides probably look like this. Exposed parts are (A) detonator, (B) explosive, (C) compressed nitrogen, (D) fuel, (E) liquid oxygen, (F) combustion chamber.

SECRET WEAPONS

by Major Malcolm Wheeler-Nicholson

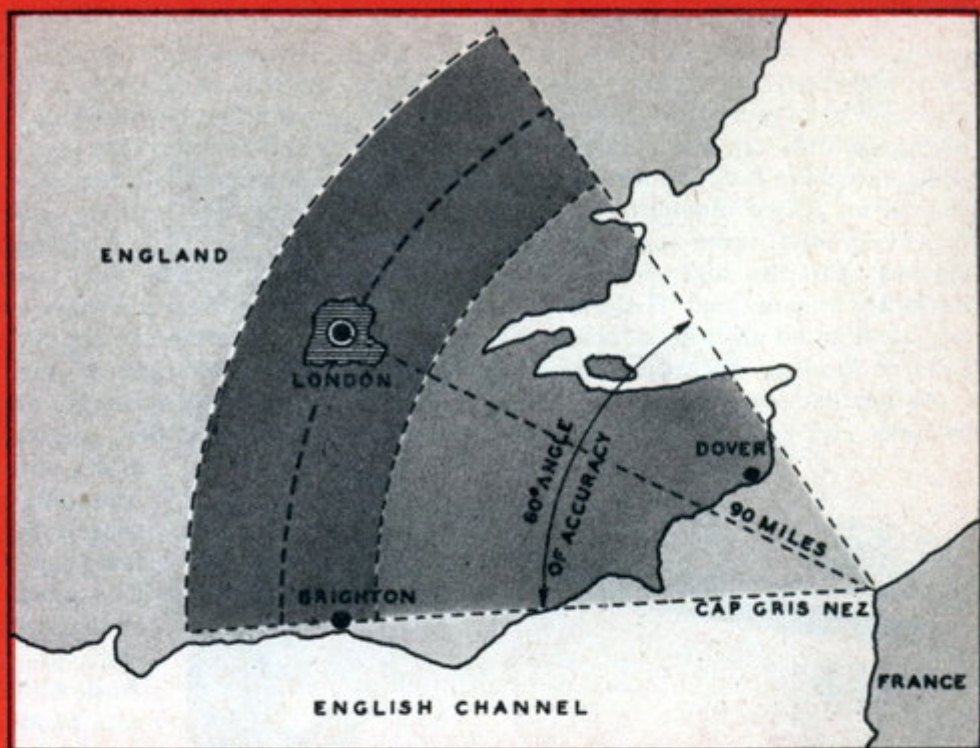
"Our new weapons," says Admiral W. H. P. Blandy, "can be and are kept secret, except that the enemy receives full knowledge of their effects." Here, in a sober analysis, MI's military analyst debunks the Herrenvolk's "secret weapon" scare.

OUT of the rumor factories of Stockholm, Bern, and Berlin come periodic threats of miracle-working Nazi "secret weapons" that will blast the Allies sky high and clinch the war overnight. Are they sheer bluff?

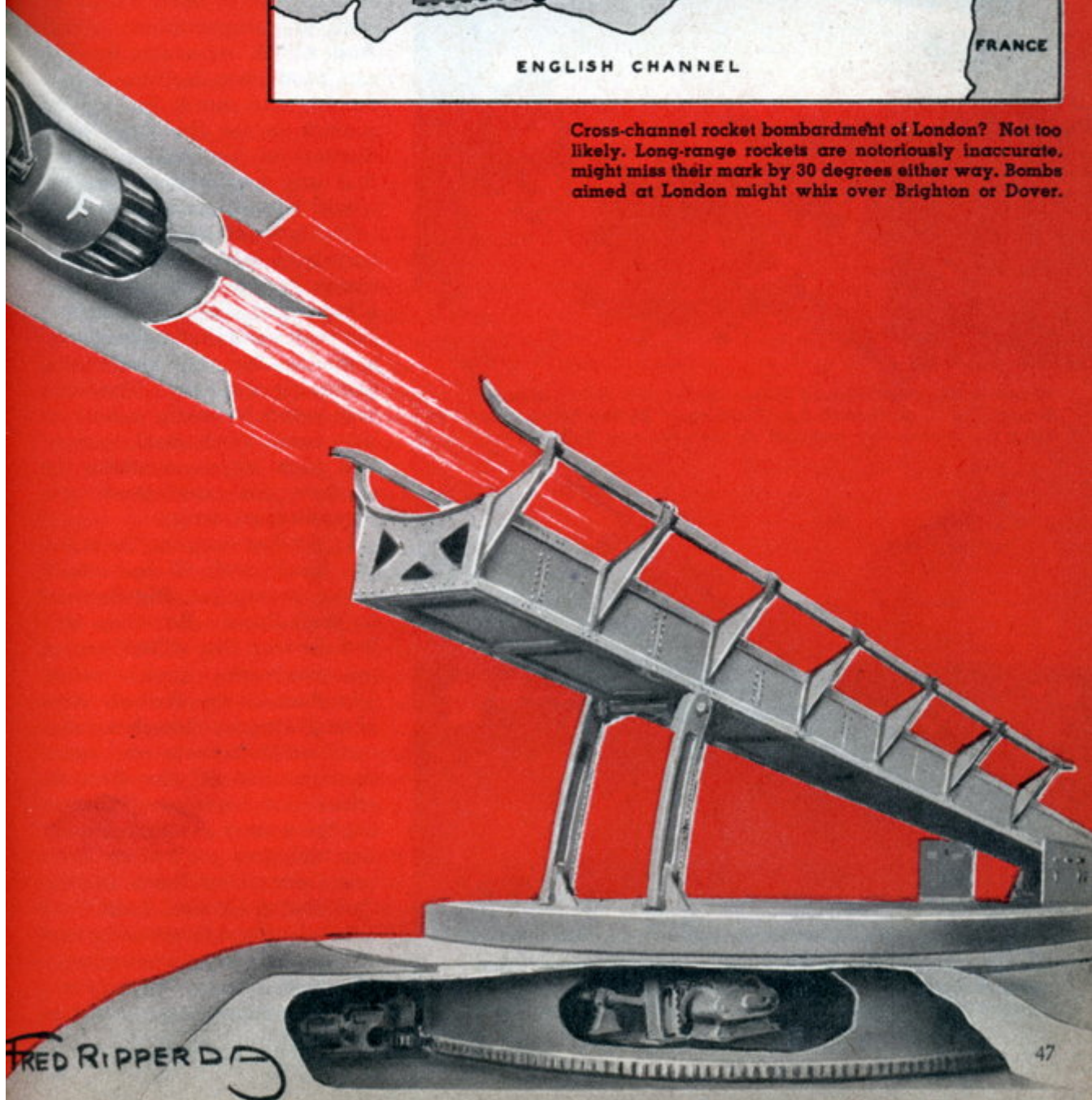
As this is being written, a hullabaloo is still raging in the press over the much-touted German "rocket bomb." Dr. Goebbels himself, fanning the propaganda flames, has claimed that a whole British convoy was wiped out in the Eng-

lish Channel in a matter of minutes by murderous long-range rocket shells. He would have us believe that the entire North French coast is a solid mass of rocket batteries capable of lobbing 12-ton bombs over London, each one powerful enough to devastate 20 square miles.

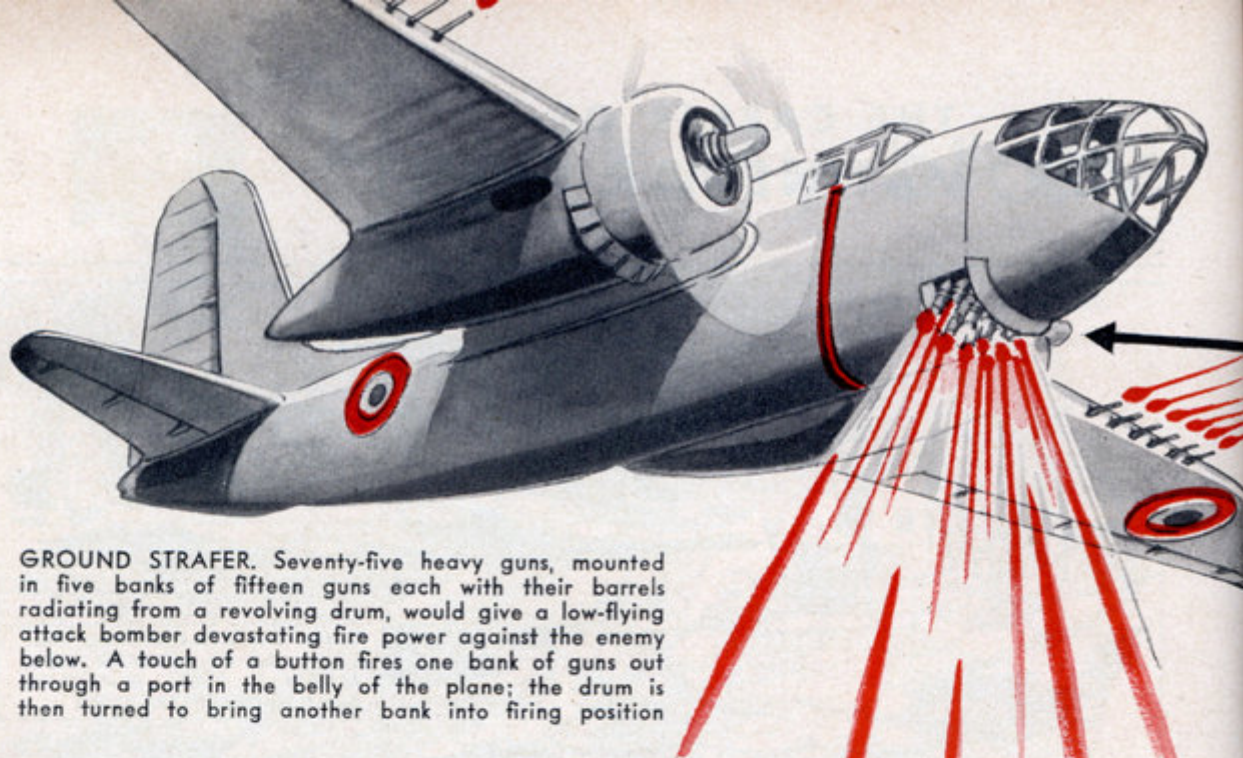
There's plenty of reason to believe that Nazi spokesmen are waging a desperate war of nerves with their flamboyant threats to pound Britain with screeching town-busters. Rockets just aren't that



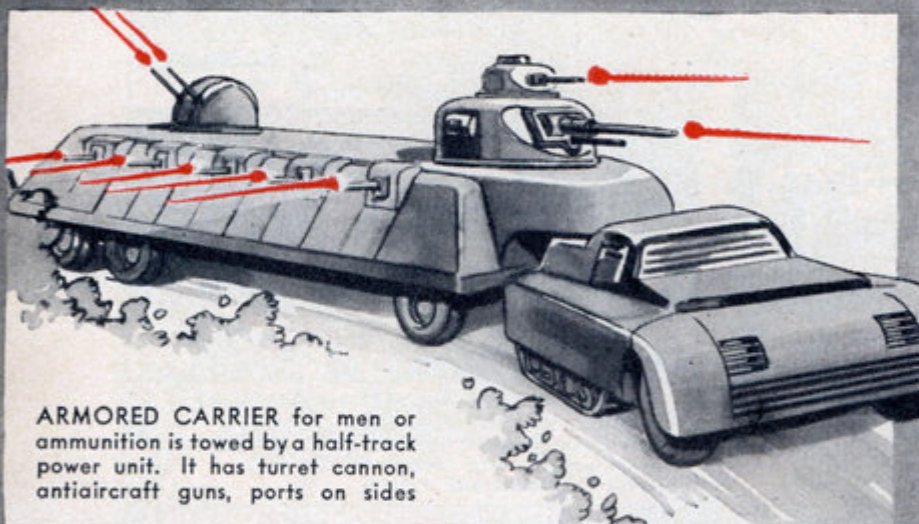
Cross-channel rocket bombardment of London? Not too likely. Long-range rockets are notoriously inaccurate, might miss their mark by 30 degrees either way. Bombs aimed at London might whiz over Brighton or Dover.



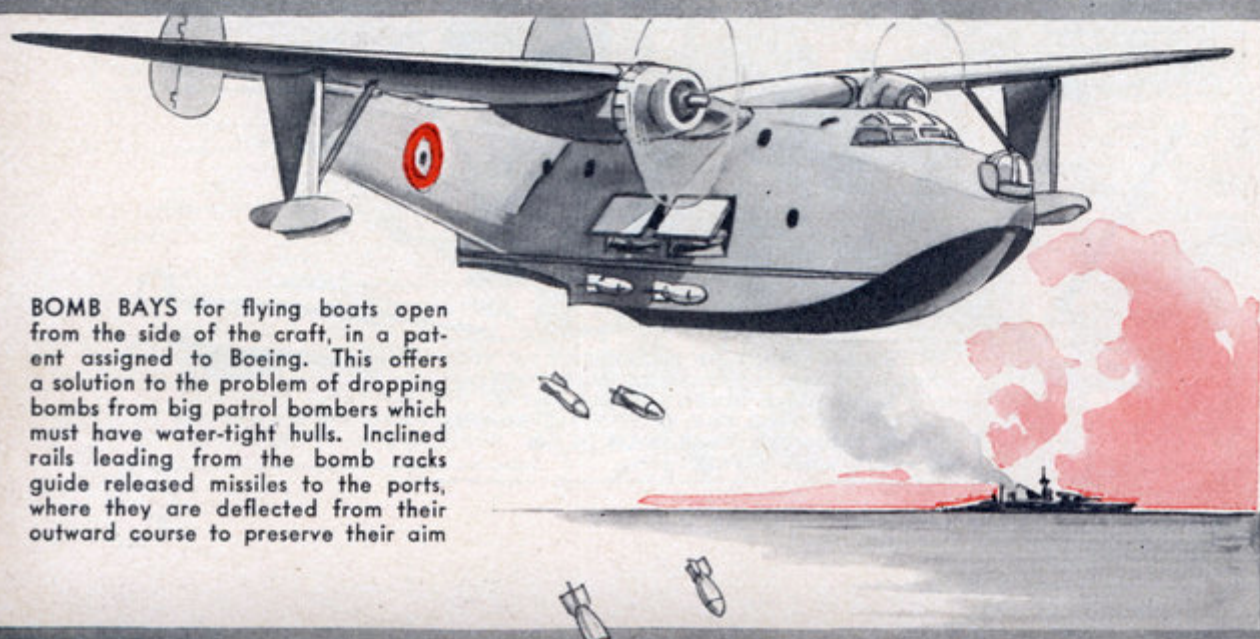
FRED RIPPERD



GROUND STRAFER. Seventy-five heavy guns, mounted in five banks of fifteen guns each with their barrels radiating from a revolving drum, would give a low-flying attack bomber devastating fire power against the enemy below. A touch of a button fires one bank of guns out through a port in the belly of the plane; the drum is then turned to bring another bank into firing position

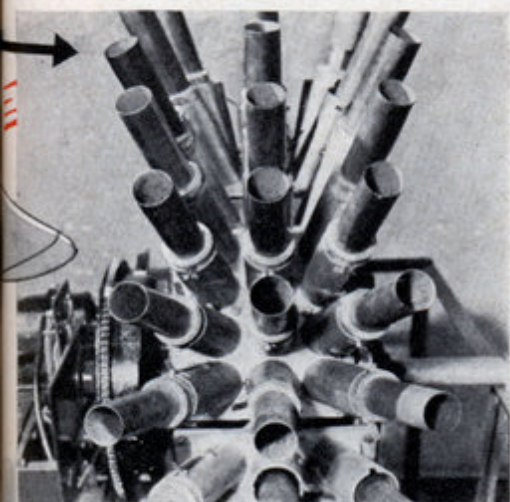


ARMORED CARRIER for men or ammunition is towed by a half-track power unit. It has turret cannon, anti-aircraft guns, ports on sides



BOMB BAYS for flying boats open from the side of the craft, in a patent assigned to Boeing. This offers a solution to the problem of dropping bombs from big patrol bombers which must have water-tight hulls. Inclined rails leading from the bomb racks guide released missiles to the ports, where they are deflected from their outward course to preserve their aim

Inventors Offer Thousands of Ideas to Help Beat the Axis



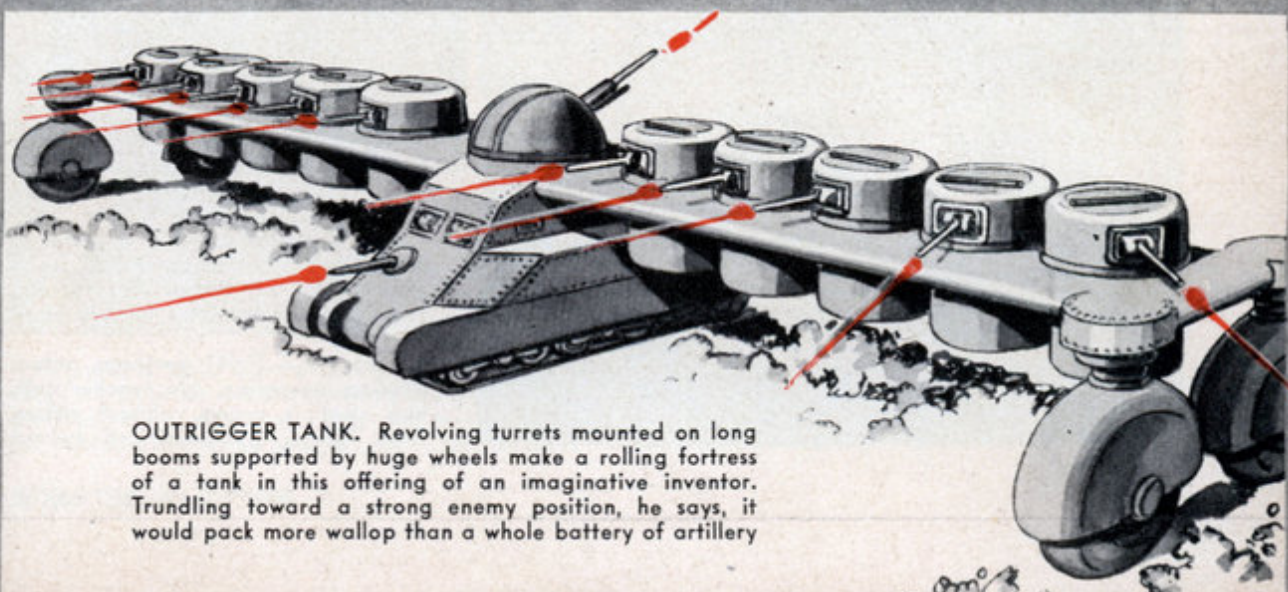
WAR inventions are flooding the National Inventors Council and the U. S. Patent Office. At the Council's headquarters in Washington, D. C., 45,000 suggestions have been received during the last year. And 3,000 of them have been adopted—one out of 15, an amazingly high proportion that pays tribute to American inventive ability. Results have well justified the effort of sorting valuable new ideas from equally well-meant schemes that prove unsuitable for various reasons.

Illustrations on these pages typify the variety of ways proposed to beat the Axis. To meritorious ideas, the National Inventors Council assigns an "A" or "B" classification, the first for inventions specifically requested by the Army or Navy. According to a recent announcement, the following will be particularly welcome:

Centrifugal, electromagnetic, and air guns; rocket-propelled projectiles; explosives from hydrocarbon vapors; remote-controlled sea and air torpedoes; mobile servicing and repair equipment for motor vehicles and aircraft; lightweight armored clothing; improved airplane catapults and retarding devices, land and submarine mines, tanks, searchlights, anti-aircraft guns, small arms, mobile landing-field floodlight equipment, and gun and bomb sights.

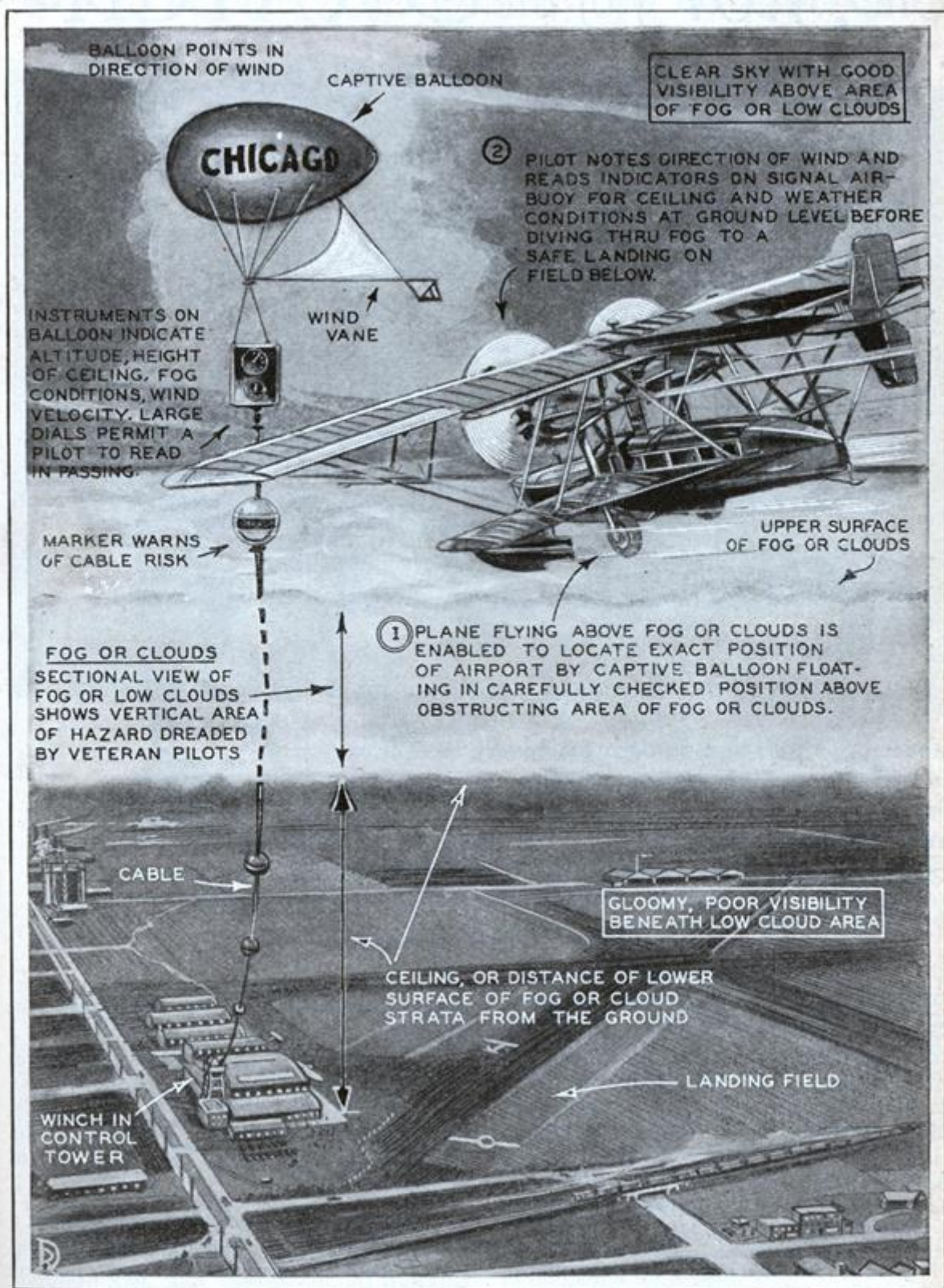
Experts who pass upon these and other military inventions include the Council's chairman, Charles F. Kettering, of the General Motors Corporation; its vice-chairman, Thomas Midgley, of the Ethyl Gasoline Corporation; Conway P. Coe, U. S. Commissioner of Patents; William D. Coolidge, vice-president of the General Electric Company; Fred Zeder, Chrysler Corporation engineer; and F. Sparre, du Pont's director of development.

Drawings by B. G. SEIELSTAD



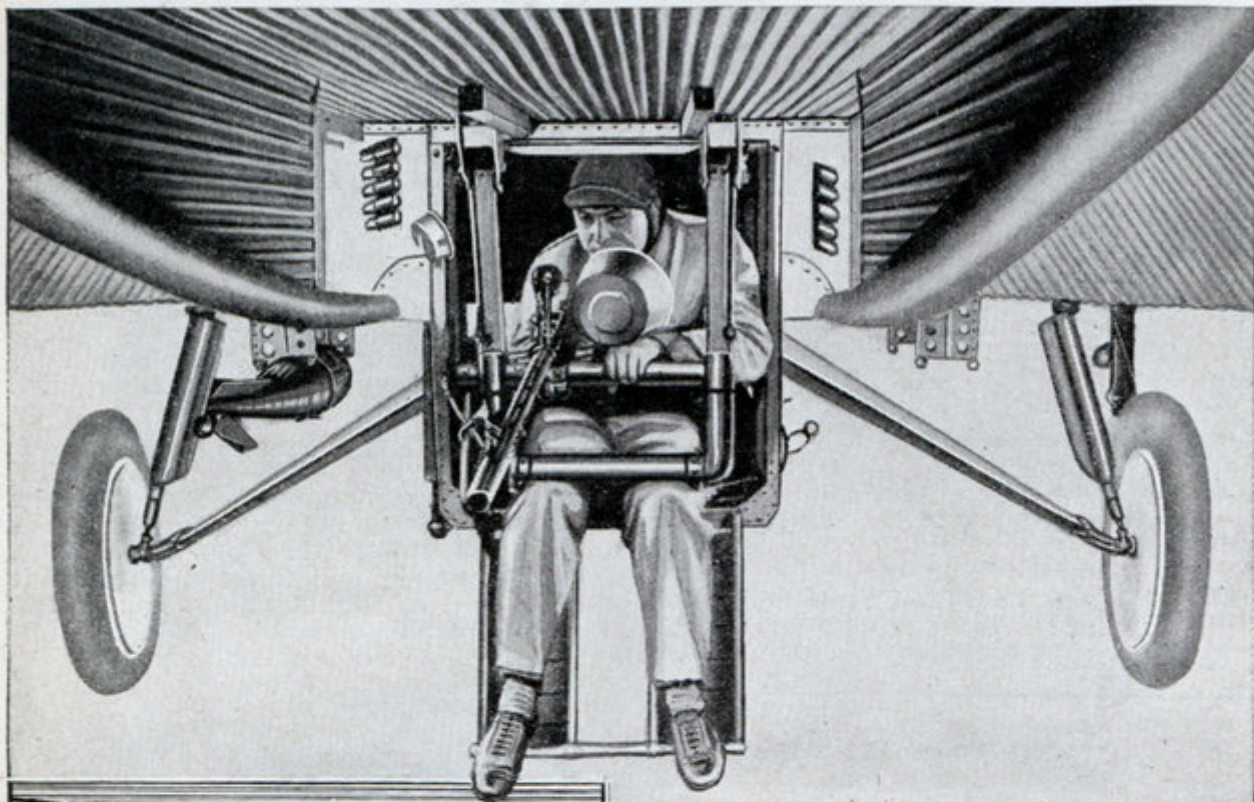
OUTRIGGER TANK. Revolving turrets mounted on long booms supported by huge wheels make a rolling fortress of a tank in this offering of an imaginative inventor. Trundling toward a strong enemy position, he says, it would pack more wallop than a whole battery of artillery

Air Buoy Marks Location of Field

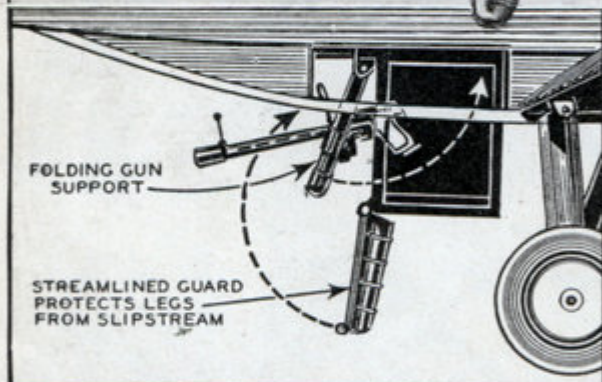


Suggested as a means of enabling fog-bound pilots to locate the position of landing fields, the floating air buoy above has won the approval of veteran airmen. A plane flying above the cloud or fog strata sights the captive balloon bearing the name of the airport, learns of conditions by reading large-dialed instruments suspended from the balloon, and is enabled to make a safe landing in spite of the fog.

Machine GUNNER SITS



This is a photo of the new machine gun perch underneath the fuselage of a plane which appears on this month's cover of the magazine. It folds up when not in use.



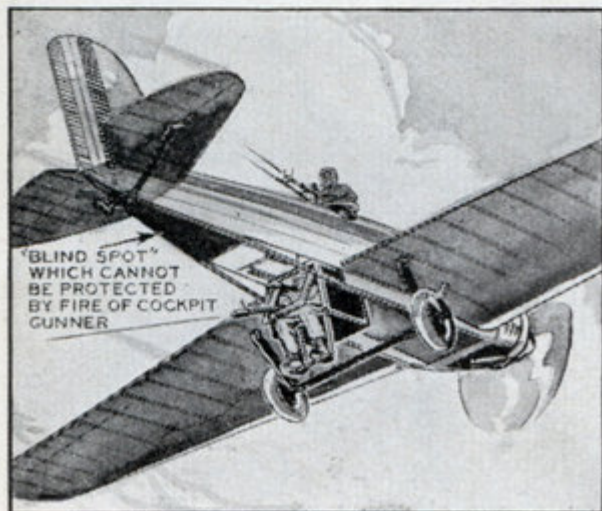
PILOTS of combat planes in the World War were acutely conscious of the fact that their ships had a "blind spot" in which they were peculiarly vulnerable to attack by the enemy. This spot included the underpart of the tail and rear section of the fuselage, which could not be defended by machine gun fire from the cockpit for the reason that the gunner would have to fire through his own plane.

Combat Technique Will Be Changed

Around this fact was built most of the strategy of aerial maneuvering, the object of the attacking plane being to come up beneath the enemy ship in the blind spot where a raking machine gun fire could be delivered without danger of return fire from the other ship.

Obviously the plane being attacked made every effort to avoid being jockeyed into this dangerous position, bringing into play every trick of piloting—and the best man usually won, with death for the loser.

It has remained for Flygindustri, a large Swedish manufacturer of airplanes, to develop a beneath-the-fuselage machine gun perch which does away with the blind spot entirely, and which may very well revolutionize prevailing methods of aerial combat technique.



Upper drawing shows how machine gun perch folds up when not in use; lower drawing illustrates need for a machine gun beneath plane to protect blind spot in tail.

SUSPENDED Under Plane

The photograph at the top of this page shows the perch with a gunner in position to attack an oncoming plane. The gunner faces the tail of his own ship, sitting in a trapeze-like box with a machine gun swinging on a special support in front of him. He can move the gun up or down and to right or left so that the old blind spot area is effectively covered.

Streamlining Reduces Resistance

Streamlined leg guards protect the gunner from the air stream, the guards also serving as foot rests. In an emergency the gunner can make a parachute jump to safety by swinging the machine gun up and out of the way.

As yet the device has not progressed beyond the experimental stage, but it has been adequately tested by its designers and found to serve its purpose marvelously well. There is a slight lessening of speed because of the frontal resistance of the perch, but the advantage of being protected against attack from all angles far outweighs this objection.

Can Leave Perch Via Parachute

A trap-door can be provided through which the gunner can descend to his perch from an upper cockpit, although in the experimental models the gunner has sat in his perch from the moment of take-off until landing, except as he may decide to descend via parachute instead of with the plane.

Heavy bumpers running along both sides of the fuselage protect the perch from damage in case the plane makes a rough landing. Leg guards fold up and the gunner sits tight until the ship rolls to a stop. It's not very

comfortable, but that's of no importance to military necessity.

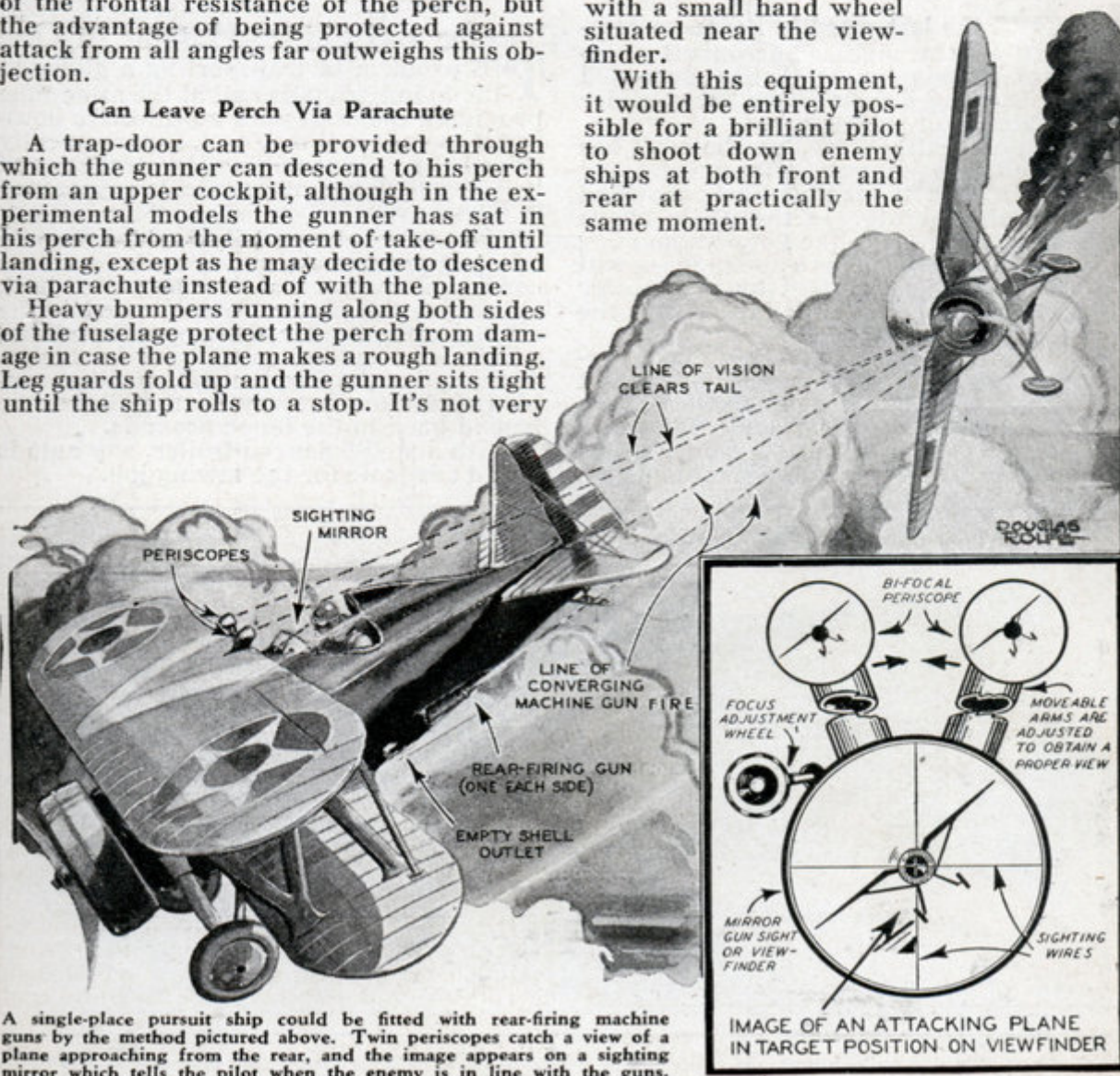
Single-place pursuit ships can likewise be provided with a machine gun defense for their blind spots by an entirely different adaptation of the rear-firing gun idea, illustrated below.

In this instance, two guns would be mounted on the lower sides of the fuselage, one on each side immediately below the pilot's cockpit, where they would be handy for clearing jams. Placed here, they would be able to direct a converging line of fire on an attacking ship.

Periscopic Gun Sights

To obtain effective aim it would be necessary to have a periscopic gun sight installed, along the lines of the mirror-sight shown in the drawing. The periscopes would be hinged to get focus and this would be controlled by the pilot with a small hand wheel situated near the viewfinder.

With this equipment, it would be entirely possible for a brilliant pilot to shoot down enemy ships at both front and rear at practically the same moment.



A single-place pursuit ship could be fitted with rear-firing machine guns by the method pictured above. Twin periscopes catch a view of a plane approaching from the rear, and the image appears on a sighting mirror which tells the pilot when the enemy is in line with the guns.

Secrets of the Mystery



The trajectory of the shells fired on Paris reached a height of 24 miles, higher than any other man-made object except small meteorological sounding balloons.

The secrets of the Paris Gun! For the first time in any magazine, *Modern Mechanics* here reveals the inside facts concerning the most startling and closely-guarded mystery of the World war—the official story of the giant German guns which, in 1918, dropped shells on Paris from a distance of 75 miles, a feat so incredible that artillery experts refused to believe it possible, thinking for a time that the shells were bombs dropped by high-flying aircraft. After the war the guns were destroyed and all information concerning them locked in secret archives. It was declared high treason, punishable by death, for anyone who possessed vital information concerning the guns ever to divulge it. Nevertheless, Col. Miller, author of this article and of the gripping book, "The Paris Gun," obtained military pictures and technical secrets from confidential German sources which has enabled him to reveal to *Modern Mechanics'* readers the astonishing story of the longest range guns the world has ever known.

ON THE morning of Saturday, March 23, 1918, as all the world knows, a supposed air bomb dropped into a Paris street and, when the fragments had cooled enough to be picked up, it was discovered they were marked with the lands and grooves of rifling, something no air bomb ever possessed.

By the time five or six more had crashed down, at intervals averaging about 15 minutes, the French artillery department had definitely decided Germany had accomplished the impossible and was shelling Paris with a gun that must be at least seventy, and probably seventy-five miles

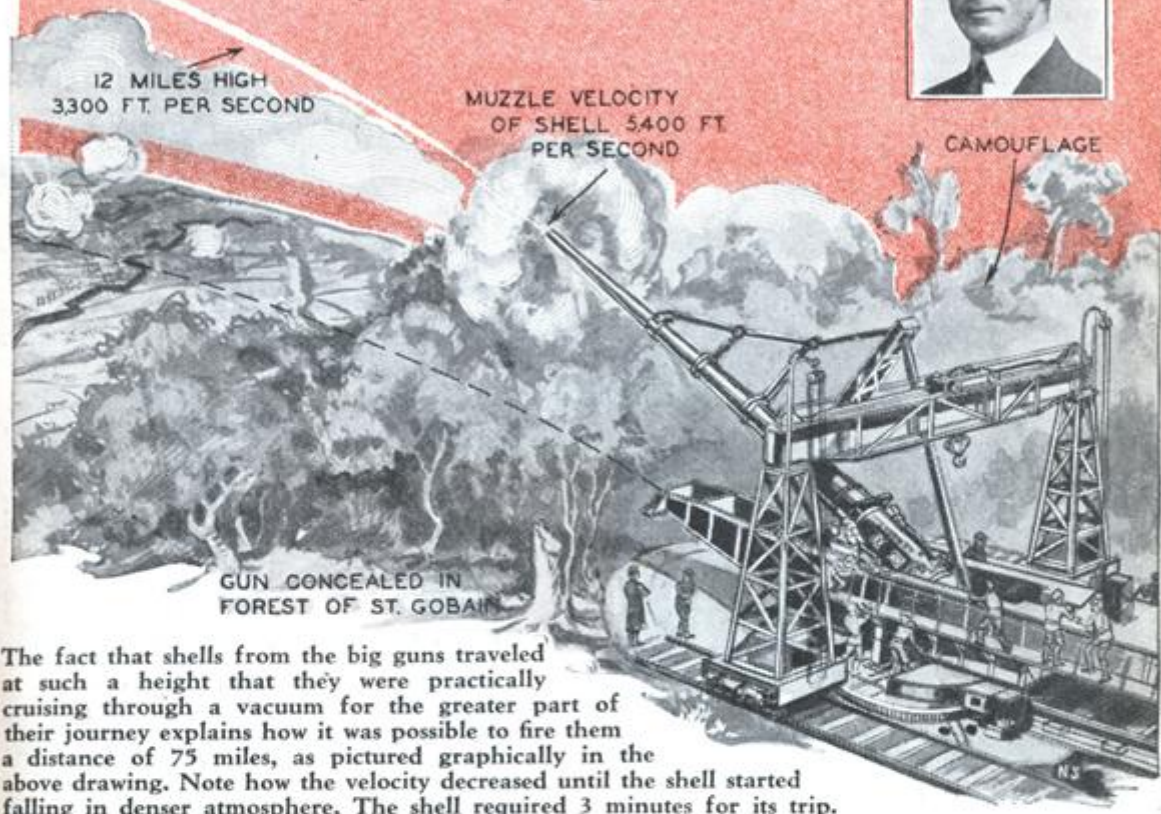
away. What that meant may be visualized by recalling that the longest land bombardment in previous history occurred in 1915 when the Germans shelled Dunkirk from a distance of $23\frac{1}{2}$ miles with a 15-inch naval gun mounted on a railway truck.

Twenty-five shells dropped into or near Paris on that March Saturday, killing sixteen and wounding twenty-nine people.

The long range gun, or rather guns, for there were seven of them built, in all, and six were actually used at the front, remained one of the war's greatest mysteries for years after the armistice, guarded by the death penalty for anyone caught revealing

Gun that Shelled PARIS

by COL. HENRY W. MILLER
Chief Artillery Engineer, A.E.F.



The fact that shells from the big guns traveled at such a height that they were practically cruising through a vacuum for the greater part of their journey explains how it was possible to fire them a distance of 75 miles, as pictured graphically in the above drawing. Note how the velocity decreased until the shell started falling in denser atmosphere. The shell required 3 minutes for its trip.

it. No gun was ever found in place, but we did find an almost complete emplacement in France, abandoned when the Germans retreated too fast to destroy it, and we did find an almost complete gun in Belgium, and the measurements of the two coincided. Long after the armistice I learned that our artillery destroyed the railroad junction at Soissons just two hours too late to catch the last of the guns as it was retreating.

But, while the guns remained a mystery, their location did not, for within two or three hours after the first shell fell, artillery experts had figured out where the monsters must be located. An aerial photograph of that district, taken on the previous March 6th, showed two railway spurs which must have been used to place them, and within a short time sound-ranging apparatus at the front had confirmed the diagnosis by identi-

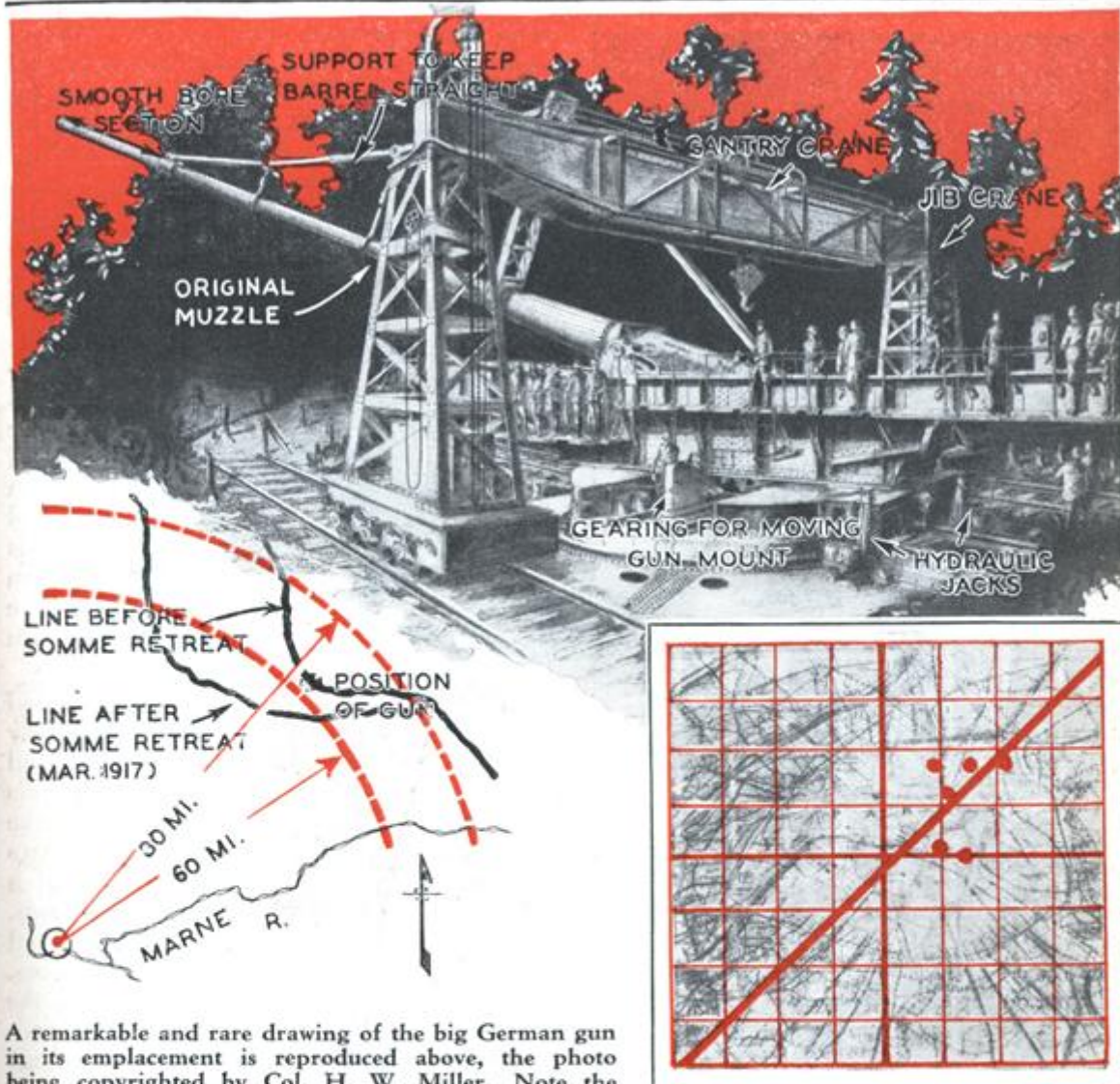
fying the sound as they fired. All that was done before dusk that Saturday, despite elaborate camouflage arrangements that even included trees with six-inch trunks set in slots in the railway line at 30-foot intervals to hide even the tracks to the gun from aerial observers.

Now that the rest of the story can be told, consider the guns themselves:

There was a barrel 120 feet in length, approximately twice as long as the biggest guns built to that time—so long, in fact, that the end had to be supported in the air to keep it from bending down and being shot off by its own shell. In fact, that very thing happened to the first of the guns tested at the German proving ground, for the barrel bent a full inch under its own weight.

Next they fired a shell 75 to 80 miles or more, over a total trajectory ranging from 90 to nearly 100 miles.

Smooth-Bore Section Added to Original Gun to Increase Firing Range



A remarkable and rare drawing of the big German gun in its emplacement is reproduced above, the photo being copyrighted by Col. H. W. Miller. Note the smooth bore section at the end of the barrel. This was added to the original gun after a retreat of the German troops, as shown on the insert map, made it necessary for the gun to fire farther than originally planned.

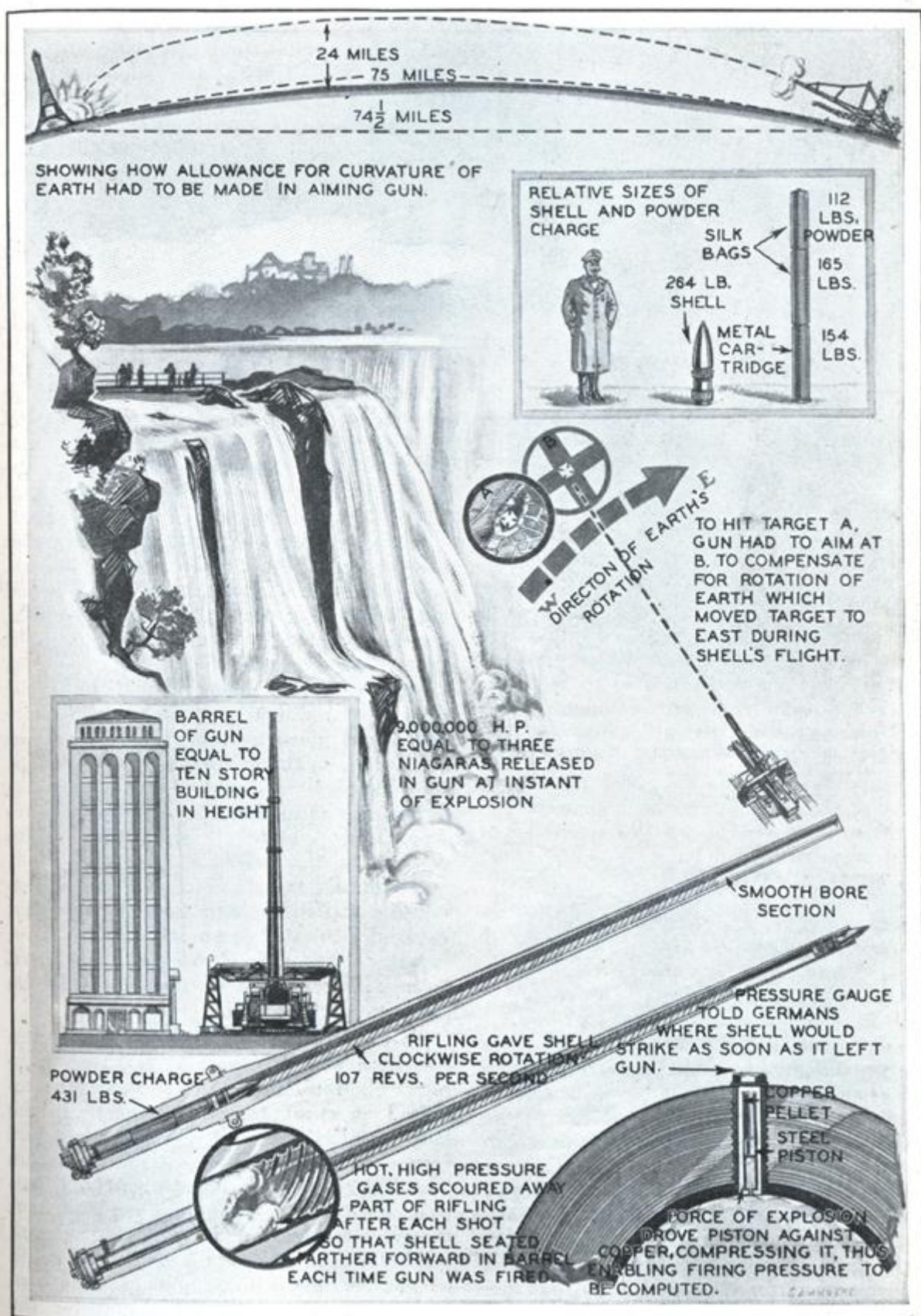
den wire from the front ordering the range to be increased to seventy-five miles. The German high command had decided to retreat the next spring from the Somme to the Hindenburg line, and a sixty-mile gun would no longer be within range of Paris.

To build the giants the Krupp factory took 15-inch, 45 calibre naval rifles, with railroad mounts, reduced the bore to 8.26 inches and just about doubled the length by shrinking into it the end of a 98-foot long rifled tube. That was the plan for the original 60-mile gun, and it had been built when the order came to increase the range to 75 miles.

The first seven shell-bursts of the Paris bombardment are shown in red on this map of the city. By plotting the city into squares, the French were able to determine the direction of the enemy gun, as indicated by the heavy diagonal red line, within a couple of hours after the first shell struck.

No one had ever succeeded in joining two rifled tubes together and keeping them in alignment, and there was no boring mill in Germany big enough to bore a barrel twenty feet longer—the extra length needed to increase the range. For every millimeter added to a gun's length the projectile will go three meters farther, and it figured out that twenty more feet of barrel would turn the trick. So the Germans decided the rifling in the 98-foot tube was sufficient to start the shell revolving and keep it from

Marvelous Features of Huge Guns Show German Inventive Ability



Entirely unique in artillery annals was the pressure gauge used on the big guns, shown in this page drawing of interesting sidelights on the gun's action. A steel piston, driven against a copper pellet of pre-determined length by the explosion, compressed the copper so that when its length was measured the pressure was easily computed.

Eighty-eight Killed When Gun Scores Direct Hit on Crowded Church



The most destructive hit scored in the bombardment of Paris came when the Church of St. Gervais was struck by a shell at a moment when it was crowded with mourners at funeral services for gun victims. The above photo shows the gaping hole in the roof and the tons of fallen masonry which crushed out the lives of 88 victims and injured 68.

To do that the shell was shot 24 miles above the earth, higher than any man-made thing, save possibly a small sounding balloon, had ever penetrated. At that extreme height the shell traveled through what was almost a vacuum, at a temperature of far more than 100 degrees below zero.

The shell, traveling at an average speed of 30 miles a minute—or sixty times as fast as the usual legal rate for automobiles—took three minutes to complete its aerial flight of 90 miles. It remained away from the earth so

long, in fact, that the old world revolved on in space while the projectile was away, so the gunners had to aim a half mile east of the target in order that the target might be there when the shell arrived to hit it.

And, finally, the Paris gun, as I have called it, was the first ever built that contained within itself a device that told where the shell had landed—in fact, the gunners could tell where the shell hit before it had actually hit there.

And to that might be added one other thing—the fact that the speed with which the Allied artillery chiefs located the guns and took steps to silence them defeated their main object, that of stampeding the people and scaring them half to death by the mystery of the thing. For the mystery, as has been said, didn't last through the first morning.

The long range guns, it might be well to explain, should not be called "Big Berthas." The "Big Bertha," named for a fancied resemblance to the matronly figure of Frau Bertha Krupp, was a short, squat, wide barreled siege mortar, a seventeen-inch piece with which the Germans reduced the stone and steel fortifications of Liege in the first weeks of the war.

The long range guns were the conception of Dr. Von Eberhardt, a German physicist, who, early in 1916, with his chief, Dr. Rausenberger, convinced General Ludendorff that a cannon with a sixty-mile range could be built. Work was started, but at the end of the year there came a sud-



An unsuccessful shell tested for the guns. The nose was hollow.

Dirigible Doomed?



by **LIEUTENANT JOHN E. HOGG**
U. S. Naval Reserve

Editor's Note: The views and opinions expressed in this article are those of the author and should not be construed as reflecting the official views or opinions of the United States Navy Department.

SOME years ago an American by the name of Holland invented the submarine. The United States recognized its military possibilities but developed a bad case of cold feet after several of Mr. Holland's early, experimental craft submerged permanently. So, we abandoned the submarine, let Germany pioneer the thing, and use it against us to our untold disadvantage in the World War.

As if we had learned nothing by that blunder the future of lighter-than-air craft development now hangs in the balance insofar as the United States is concerned. Because

REMARKABLE RECORD OF THE GRAF ZEPPELIN

Under the command of Dr. Hugo Eckener the Graf Zeppelin is in its seventh season of trans-ocean commercial flying this year. It has made 60 crossings of the South Atlantic, seven of the North Atlantic, and one of the Pacific.

The Graf Zeppelin has flown 1,025,271 miles. In 1929 it flew 21,700 miles around the world with 20 passengers in 20 days, 4 hours.

This summer Germany's new dirigible, the LZ-129, the world's largest, will make its maiden flight. Capable of carrying 50 passengers, it may fly the Atlantic to the United States.

The Macon preparing to land at the hangar at Sunnyvale. Destruction of this ship in the Pacific near San Francisco has renewed debate over the value of lighter-than-air craft.

three of the four helium airships we have owned and operated have crashed from structural failures, a considerable demand has arisen that we spend no more money and risk no more lives in the attempted development of a type of aircraft now termed by many—a demonstrated impracticability.

If the mob psychology bred of the Shenandoah, Akron, and Macon disasters leads us to abandon further dirigible development, even temporarily, the results may be far-reaching and inimical to our national hopes and ambitions. We may repeat our mistake with the submarine. Some more far-seeing and less-easily-discouraged nation will undoubtedly carry on from the point where we leave off. To that nation we may surrender future naval supremacy and commercial advantages of incalculable value.

The history of dirigible pioneering has admittedly been disastrous, but there is nothing in it to indicate that successful lighter-than-air craft are impossible of attainment. The use of hydrogen, an explosive gas, as the agent of aerial buoyancy has been responsible for the loss of most of the dirigibles built prior to

[Continued on page 127]

Can We Meet the Robot's Threat?

How Automatic Weapons

Crewless planes . . . mechanical brains that think faster than man . . . remote-controlled bombs with new, superpower explosives . . . vengeance-wreaking automatons designed for mass murder . . . guns that can't miss . . . instruments that see through clouds and darkness—these new terrors imperil the peace of the future.

By ALDEN P. ARMAGNAC

Drawings by B. G. SEIELSTAD

WILL death-dealing automatons, sooner or later, imperil the lives of everyone? Long-secret war weapons, now brought into the open, raise the startling question. They see through clouds and the darkness of night, when human eyes are blind. Faster than a man can think, their mechanical brains perform intricate calculations and aim guns against swiftly moving targets. They blast objectives with a ton or more of high explosives from more than 150 miles away. Stranger even than the fiction of a Jules Verne or an H. G. Wells, they still offer only a preview of what war may be like in days to come.

Germany's "vengeance weapon" V-1, a jet-propelled "flying torpedo" or robot bomb, became a grim reality to Londoners last June. While the long-range gun that bombarded Paris in the last war fired a projectile weighing only 264 pounds overall, V-1 carried no less than 2,200 pounds of high explosive alone. Moreover, the flying torpedo boasted more than twice the range of the shell. Once launched from a ramp in the general direction of London, it followed a more or less direct course, wind permitting, under the control of a simple gyro pilot. Then, any sort of timing control—a clock, or exhaustion of a measured quantity of fuel—tilts the infernal machine into a dive to earth. A firing pin clicks, and the full force of the explosion rends whatever is hit.

A devilishly ingenious automaton, this—difficult enough for speedy fighter planes or anti-aircraft guns to shoot down in clear daylight, let alone fog and night. Its only fault from a humane point of view was that no one knew where it would land. Guns and bombing planes can score amazingly accurate hits on legitimate military objectives. But practically all the targets of the V-1, considering its extreme range and random point of fall, naturally have included such nonmilitary items as a queue of children waiting to board an evacuation train; theaters; hospitals; and the vast expanse of dwellings of ordinary workers. Knowing

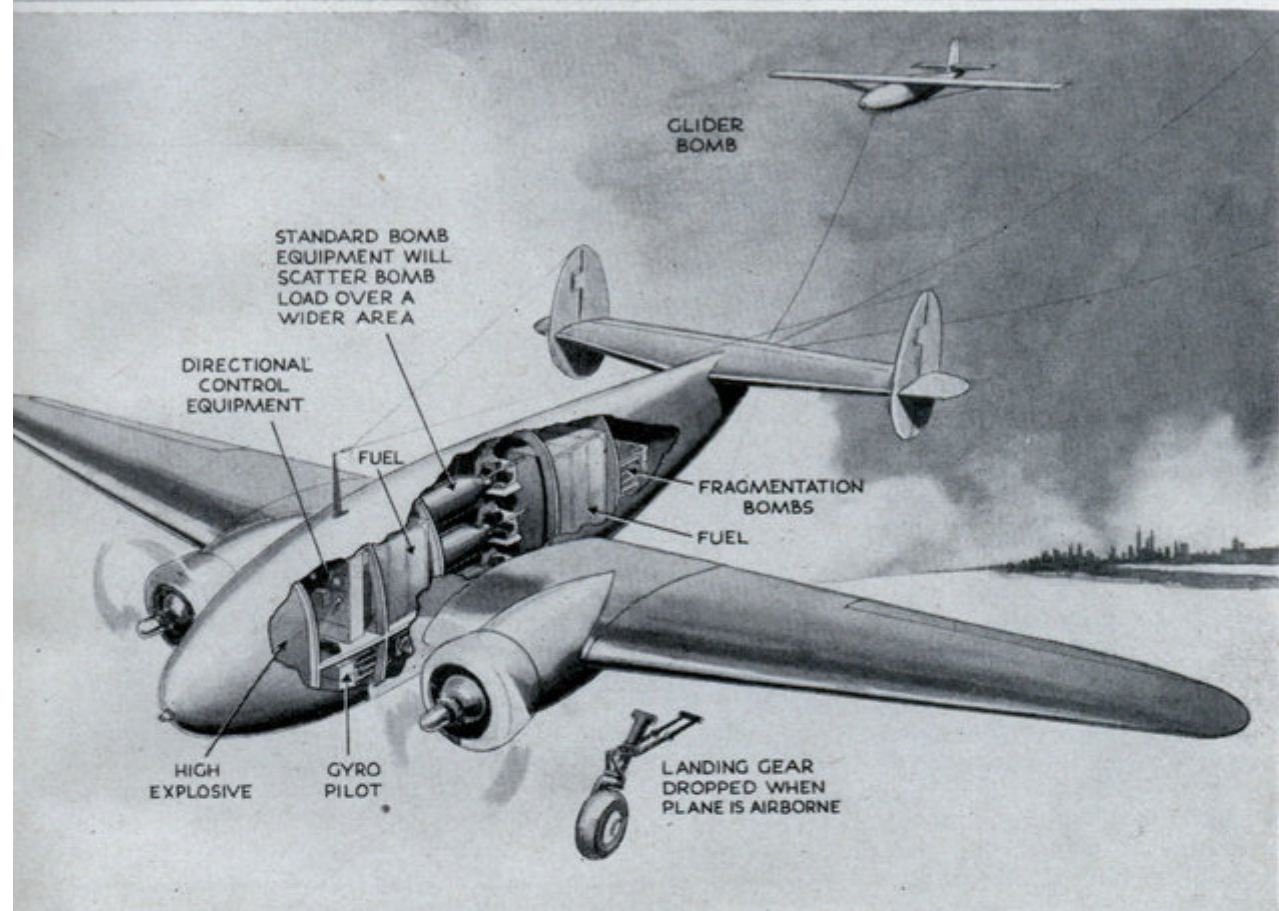
this, the Germans obviously adopted a policy of indiscriminate bombing. They took what satisfaction they could from the fact that, in the first seven weeks of bombardment, flying torpedoes killed 4,735 men, women, and children, and seriously injured 14,000 more. Compared with London's aerial "blitz" of 1940-41—when German bombers, given the benefit of the doubt, possibly tried to hit war centers—the V-1 exacted a daily death toll two thirds as high.

Here was the first open declaration of war—or, if you prefer, of mass murder—against a whole population. Of course, in this case, Germany will regret it. But it set a terrifying precedent for any conceivable war of the future. The spectacle of great nations bent on exterminating each other, failing intervention of a world police force, seems neither incredible nor too remote to contemplate. Crewless and remote-controlled weapons of today suggest some of tomorrow's ruthless engines of war.

Fighting robots with robots holds dramatic possibilities, some of them already realized. Imagine, for example, that a German plant making flying torpedoes is to be bombed on a certain day. Allied raiders find the target heavily blanketed with clouds that no human eye can pierce. But they are prepared for that. In the leading plane, a "robot eye," or fog-piercing telescope, gives a cloud-free image of the target. Just at the moment that the bombardier would normally let go with explosives, he releases a smoke bomb that forms an air marker. Following planes simply drop their bombs through the hole in the smoke ring to score bull's-eye hits. At night, parachute flares replace plain smoke. Remarkable successes have been credited to American and British airmen using the new technique, which is based upon research by scientists of both countries. In case enemy planes should attempt to lay false air markers and thus mislead our bombers, colored smokes and flares may be used, and the hue changed like a countersign from day to day.

No doubt every Nazi, boiling with helpless rage at the havoc wrought by made-in-U.S.A. bombs, has longed to see New York hit by flying torpedoes. On a token scale,

Are Changing Warfare



Pilotless planes, loaded with explosives and towing gliders with more, may cross oceans to strike large target areas. This is our artist's conception of an actual present-day plane equipped for such service

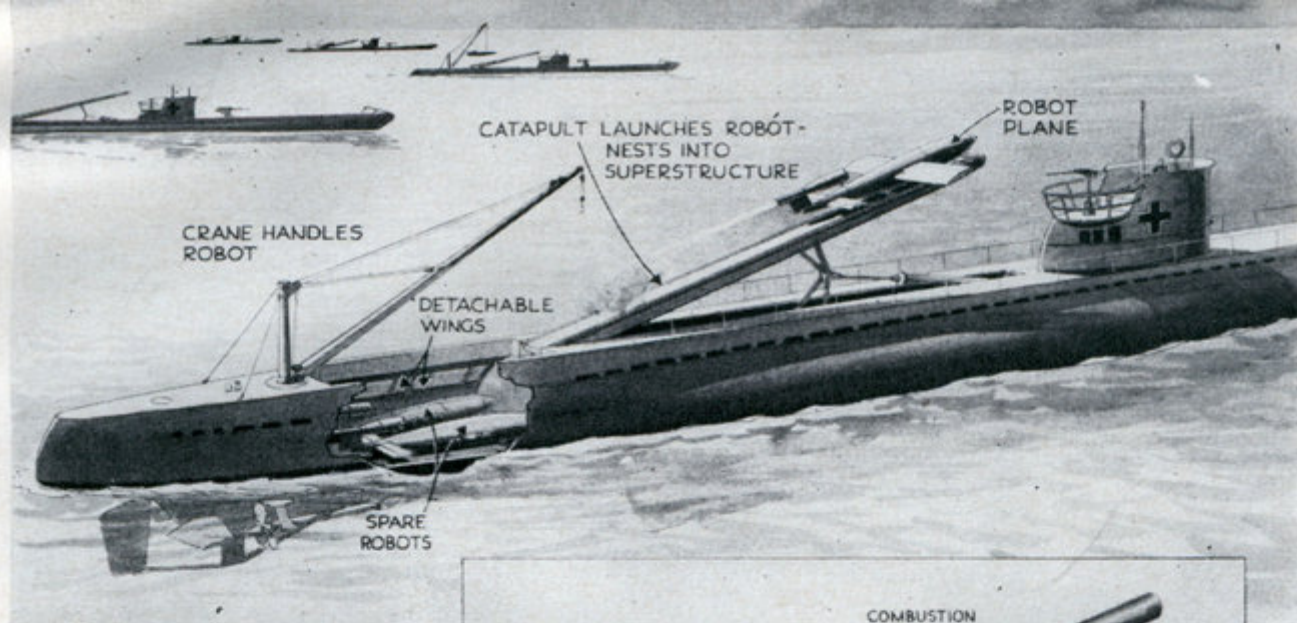
it might be tried, if the Germans considered the attempt to be worth the risk. For this purpose, at least, there need be no question of transatlantic projectiles. Submarines have carried manned airplanes, and could transport winged torpedoes as easily. A retractable launching ramp on deck should impose no difficult engineering problem. Standing 50 to 100 miles offshore, with ramp erected and a V-1 in place, a U-boat could bombard the world's greatest port with a fair chance of hitting something, somewhere. But to launch its flying torpedo, the submarine must surface. And that is taking the dangerous chance of being spotted by radar equipment on warships and patrol planes, which would make short work of it. Again, robot versus robot.

If a Messerschmitt 210 happened to tangle with a B-29 Superfortress, you might witness the extraordinary sight of unmanned turret guns firing at each other.

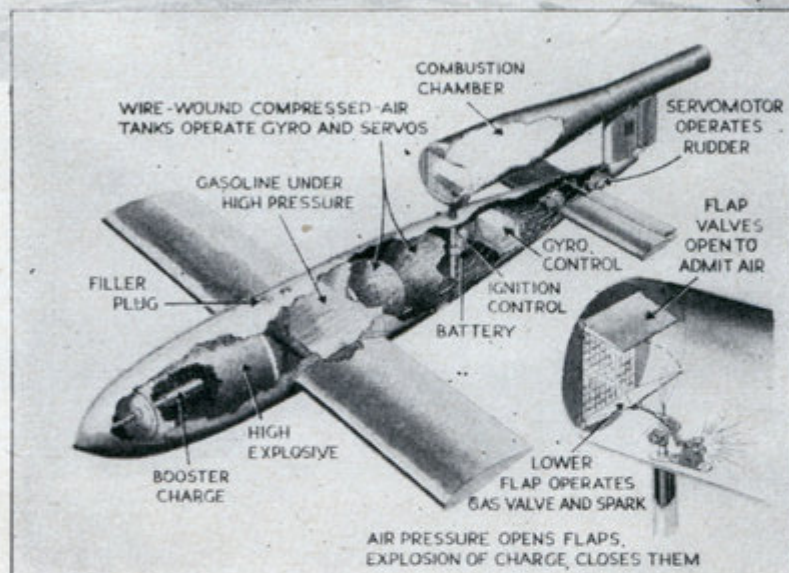
Comfortably seated at the best vantage points of the plane, gunners fire their weapons by remote control. Manipulating a handle bearing an electrical sight automatically turns a distant turret, and trains its guns, by means of "selsyn," or power-amplifying, mechanism. The scheme eliminates possible blind spots where a gunner might fail to see a hostile plane approaching his arc of fire.

Here is an interesting note on future war weapons: The intricate sights that guide a bomb to its target, as used by Allied flyers, now have "zero error." In other words, they operate with such extreme precision that no possible improvement would be of practical use. Such factors as split-second mechanical lag in bomb-release mechanism will take precedence for future research.

"Here it comes—there it goes" describes what antiaircraft gunners are up against, when they try to hit V-1's and the even speedier fighting planes. By the time a pro-



"Flying bombs" like those that hit London could be launched against U.S. seaboard areas from submarines lying 50 to 100 miles offshore. Retractable ramps would be used as visualized in the drawing. Details of the Nazi vengeance weapon, based on latest data, are shown at right

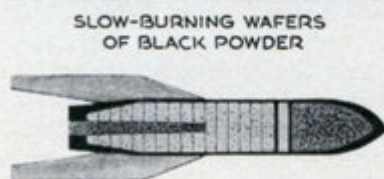


jectile reaches the altitude of a bomber flying 20,000 feet high, the plane will have traveled a mile. And in the time it would take a human brain to calculate where the gun should be aimed, the target would long since have vanished.

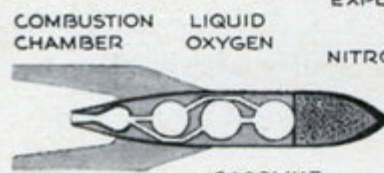
Therefore, mechanical or electrical brains, called directors, instantaneously compute the firing data for antiaircraft crews and for aerial and naval gunners. Once these complex thinking machines, among the most

intricate pieces of war equipment, seemed to defy production in quantity. But U. S. output in the two-year period between December, 1941 and December, 1943 increased by 3,000 percent, according to a recent an

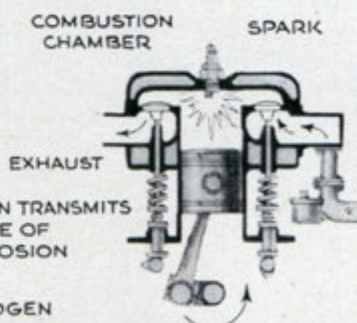
ROBOTS GET THEIR DRIVE BY HARNESSING EXPANDING GASES



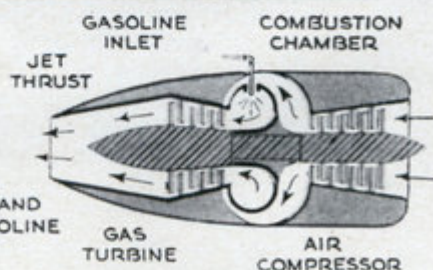
SOLID-FUEL ROCKET



LIQUID-FUEL ROCKET

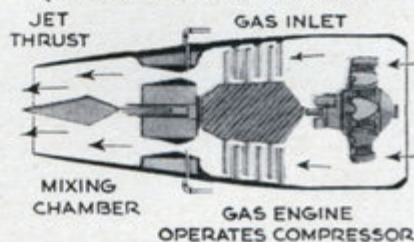


INTERNAL-COMBUSTION ENGINE USES SAME BASIC PRINCIPLE AS LIQUID-FUEL ROCKET AND JET ENGINE, BUT APPLIES FORCE OF EXPLOSION MECHANICALLY INSTEAD OF THROUGH JET THRUST AGAINST AIR



JET ENGINES

(CAN ALSO TURN PROPELLERS)





May 22, 1928

L. B. SPERRY

1,670,641

MECHANICALLY FIRED MISSILE DEVICE
Original Filed April 18, 1919 4 Sheets-20cm

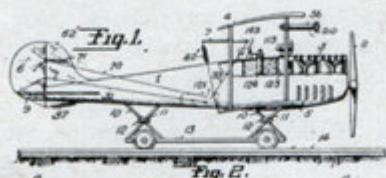


Fig. 1.

March 20, 1928

J. PEPPER

1,663,058

GUIDING PROJECTILE

Filed July 1, 1927

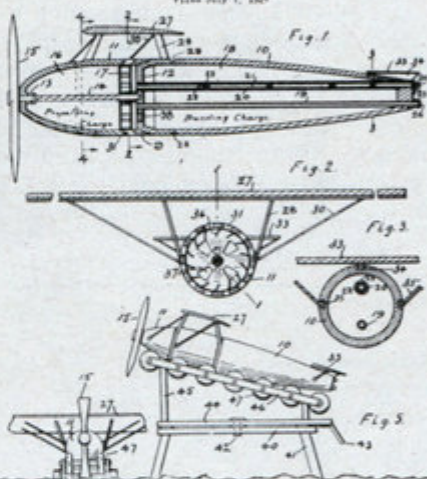


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

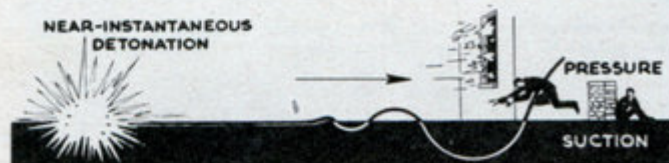
ROBOT PLANES ARE NOT NEW. Twenty-five years ago, the Modisette "Hot Shot" used timing gears to fly itself over a target area, release bombs, and fold up into a crash. Our Navy tried out crewless planes in World War I. Since then, inventors such as Hammond, Kettering, and the Sperrys tackled the problem

targets for Navy guns and bombs.

To return to the current battle-front, a radio-controlled German "tank," more interesting for its novelty than its military value, has also appeared on the Italian front. Its driver steers the 12-foot-long vehicle as near the enemy as he dares. Stepping out, he guides it onward by a portable transmitter. At its destination it stops and drops a time-fused, 800-pound explosive charge. Then its driver calls it back by radio, and makes his getaway. Details are lacking as to what the explosive is intended to do, and why.

Mobile land mines, resembling

NEW EXPLOSIVES BRING NEW PERIL. "Blast effect" produced by the near-instantaneous detonation of recently developed explosives calls for new precautions on the part of civilians for self-protection



12,000-POUND BOMBS, like the RAF "cookie" below, set a new high-water mark in destruction. Before-and-after photos at right show what just a few of these babies did to the Gnome-Le Rhone aero-engine works at Limoges, France, in a visit by the Lancasters



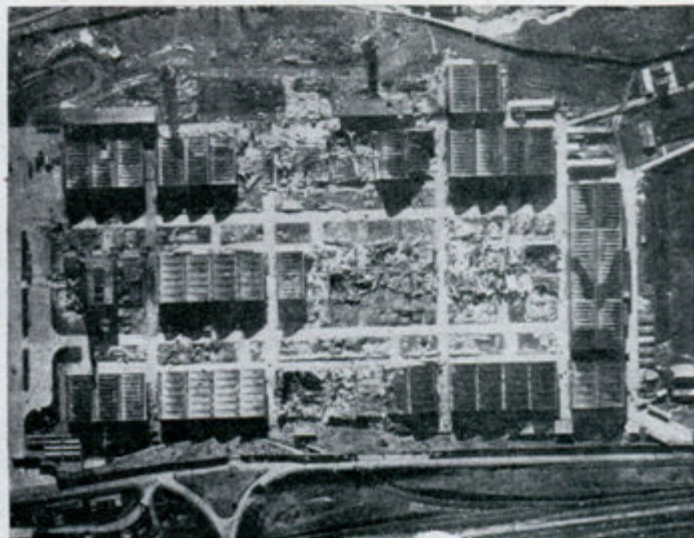
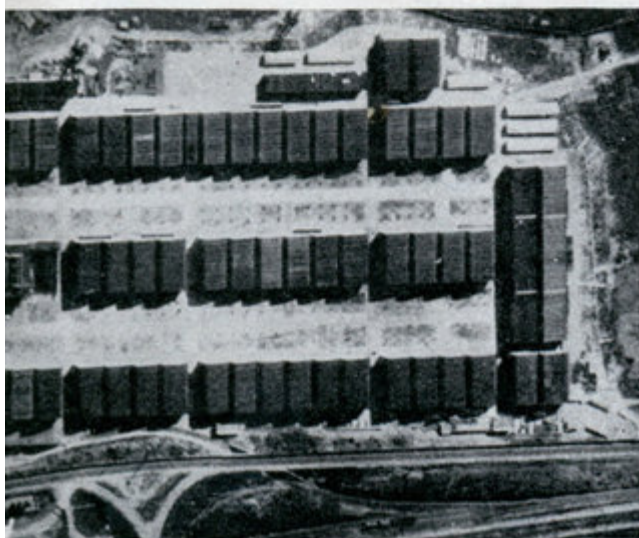
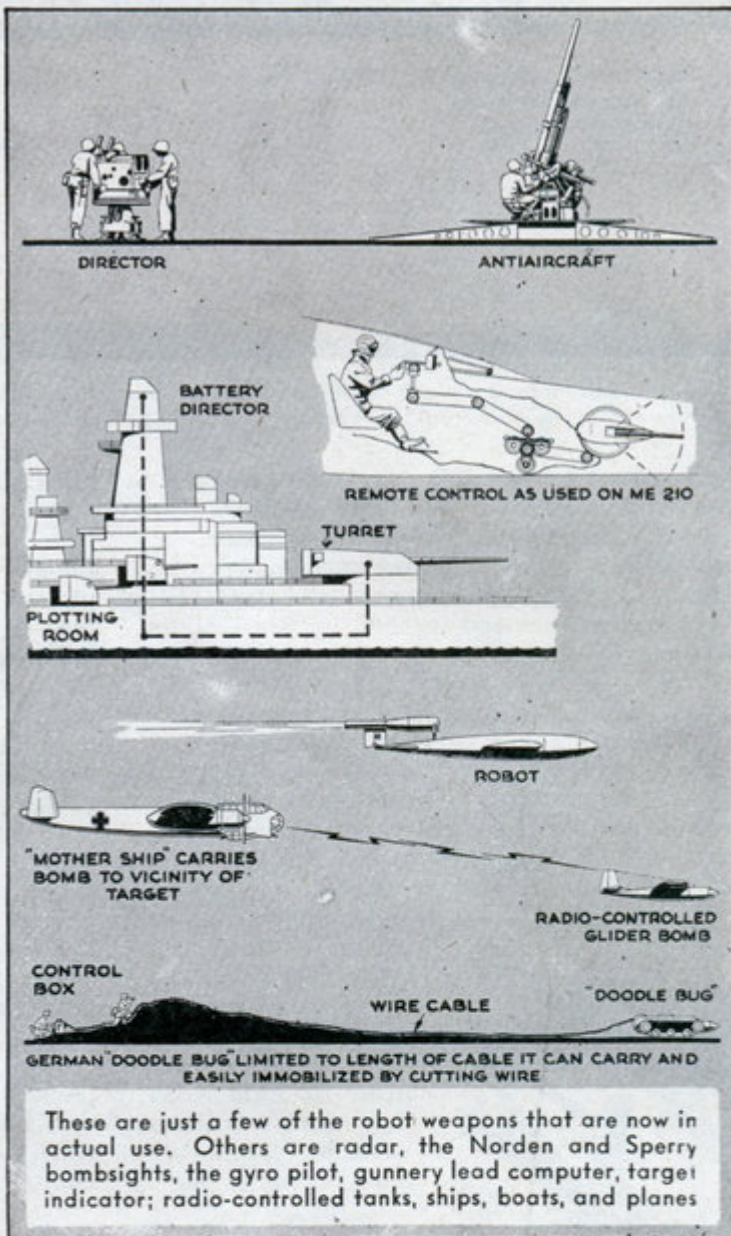
toy-sized tanks and stuffed with 250 pounds of explosives, exhibited an even simpler method of remote control at the Anzio beachhead in Italy. Propelled by self-contained electric motors, under power received through trailing cables, they were designed to be exploded by the operator as they scuttled beneath barbed-wire entanglements or among invasion troops. Delighted with the new targets, Allied gunners went to work on them in a shooting-gallery mood. Not one of the robots escaped. Those that were not blown up made amusing, if battered, souvenirs. Hunting was better when the Allies invaded France, where numbers of intact "doodlebugs" were found abandoned by the Germans.

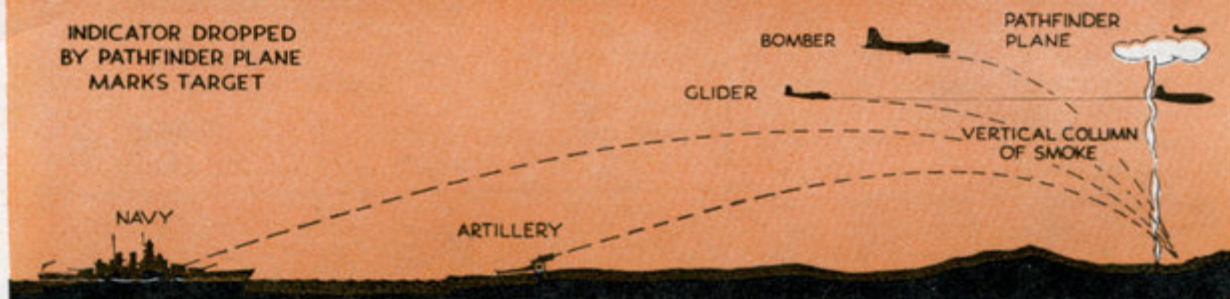
A meal that cooks itself probably ranks as the favorite robot of the average GI. After punching holes in the top of a food can, he ignites a packaged charge of fuel extending down a central compartment. In four minutes the contents are steaming hot and ready to eat. The enemy may find this one of the deadliest of Allied robots—for who will deny that a well-fed American soldier can lick his weight in wildcats?

Special weapons deal with some enemy robots. For example, fields sown with land mines have allowed Axis forces to retreat in time to avoid destruction. Allied pursuit has had to wait until a pathway has been cleared of mines and marked. Now, however, vehicles acting as mine destroyers lead the way straight through the danger zone. Revolving drums in front of them beat the earth with flails of heavy chain, exploding the mines a safe

distance ahead of them. One British type, designed for this sole purpose, might be called a land minesweeper. Tanks have also been equipped with the flailing apparatus.

Next to the use of automatons, revival





Clouds can't hide a target from bombers, artillery, or airborne troops. A fog-piercing "robot eye" in a pathfinder plane picks up the objective. Pathfinder drops bombs that trail a stationary column of smoke

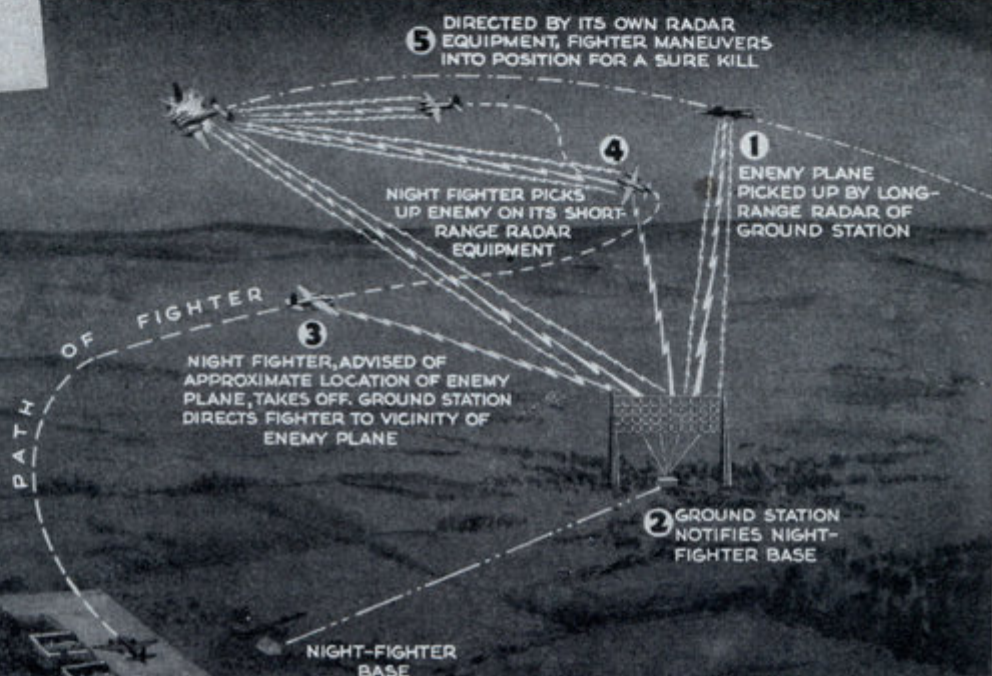
of rocket weapons has furnished one of the major surprises of the current war. The rockets whose "red glare" has been immortalized in our national anthem were not signal rockets, but the first effective military rocket, devised in 1806 by Sir William Congreve and used by the British in the War of 1812. But war rockets gave way to rifled guns of superior accuracy. It remained for modern designers to give rockets at least fair accuracy, so as to make the most of their outstanding advantages—absence of recoil, and light weight in comparison with artillery of equal firepower. So well have they succeeded that rockets bearing explosive or incendiary charges have become indispensable weapons in the air, at sea, and on land.

About the beginning of this year, American warplanes such as the Grumman Avenger began

hunting U-boats with rockets, particularly suited to the purpose because the propelling tube continues to drive its explosive head under water. British pilots of speedy Typhoons have specialized in low-altitude, high-speed rocket attacks on enemy tanks, with devastating results. Rocket duels between planes have occurred beyond bullet range. Against Japanese troops and ground installations in the China-Burma-India theater, Allied dive bombers have launched rockets from 4½-inch "flying bazookas" with pin-point precision. In one of the latest designs, planes fire rockets in clusters of three, mounted beneath the wings.

How to keep an invasion beach clear of defenders, during the fateful moments between the end of a naval barrage and the landing of the first assault wave, has been a problem solved by the Navy with rockets. A bit longer than three-inch shells, they packed explosive power almost equal to that of a destroyer's main battery. For use, they were carried in racks flanking an armored cockpit-bridge, in special landing-support

RADAR vs. RAIDER. Here our artist gives you his idea of the way robots foil night bombers. Long-range radar picks up the intruder and guides a night fighter close enough for his own short-range radar to take over the job. Inset at left shows the AAF's new P-61 night fighter. (See cover painting)





European-type windmills like this have enormous sails that sweep the air in circles sixty to eighty feet in diameter



Americans can design windmills to beat the Dutch. As this photograph proves, the more efficient narrow-blade type has even invaded the land of the dikes

New Schemes for

INVENTORS PROPOSE STRANGE PLANS

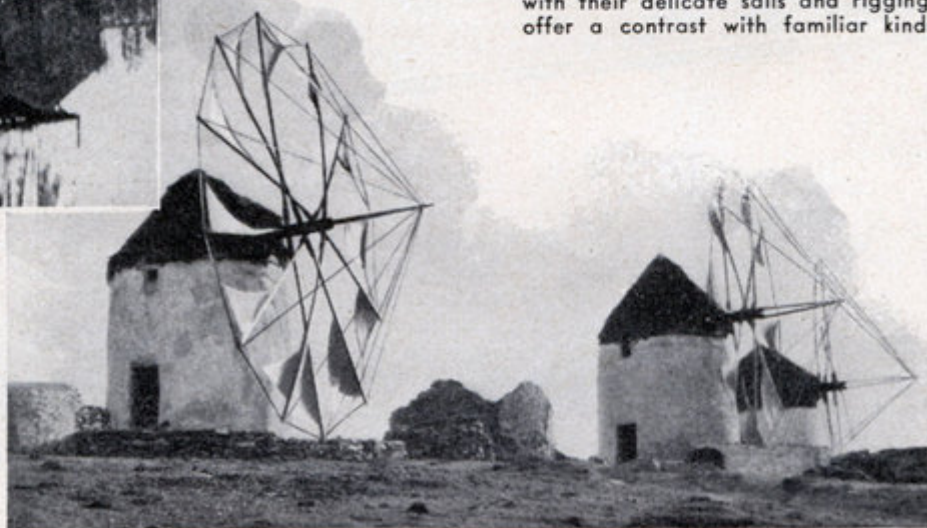
IS THE windmill coming back? With strange, unconventional types, inventors are seeking to adapt it to a modern age. Their experiments may bring new success in man's effort for 800 years or more to harness the wind for power.

Centuries ago, people milled their flour, sawed wood, and pumped water with the picturesque European windmills whose enormous "sails" swept from earth to sky. This country contributed the smaller and more practical narrow-bladed type that pumps water on farms today. A new miniature design shaped like an airplane propeller charges storage batteries for radios and for lighting rural homes.

To provide power on a larger scale, giant structures envisioned by modern designers would reach heights where winds constantly blow. One inventor, Hermann Honnef, proposes to mount 500-foot wheels, with spokes that serve as vanes, upon high towers. A single "skyscraper windmill" of this type, he estimates, would generate enough electricity for a city of 100,000 inhabitants. Another designer, Peter Bendmann, offers plans for a pair of giant windmills, connected at right angles to each other and arranged to move around an endless track so as to obtain maximum power in wind from any direction.

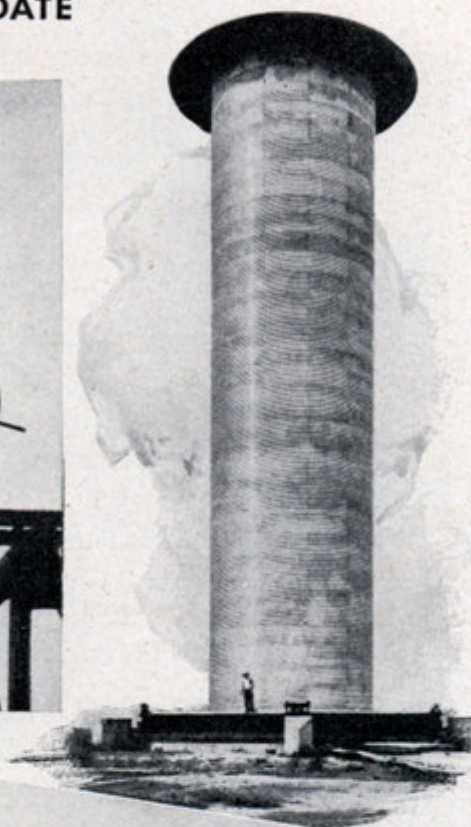
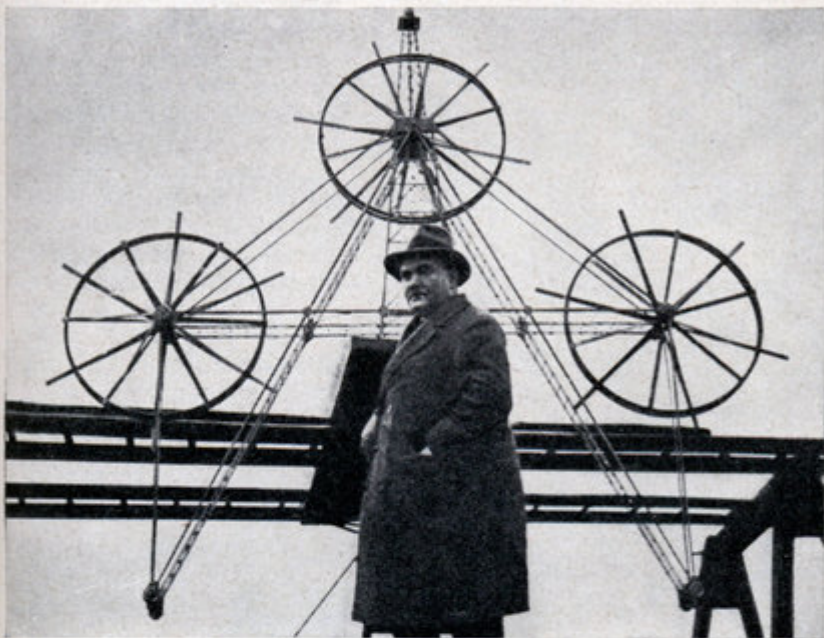
At Burlington, N. J., recently, a spool-shaped rotor ninety feet high strained at its moorings with a ten-ton horizontal pull, when an electric motor spun it in the wind. The inventor, Julius D. Madaras, plans to mount twenty such rotors on flat cars, and make the wind propel the whole train around a circular track. Dynamos geared to the car wheels would generate many times the amount of power needed to turn the rotors, and the surplus would be marketed.

Primitive wind power plants in Greece, with their delicate sails and rigging, offer a contrast with familiar kinds



Harnessing the Winds

TO BRING THE OLD DUTCH MILL UP TO DATE



Hermann Honnef and a model of the 500-foot wind wheels he proposes to erect on tall towers. At far right is a rotor-type "windmill" recently tried out. Twenty of these on flat cars would run around a track to generate electricity



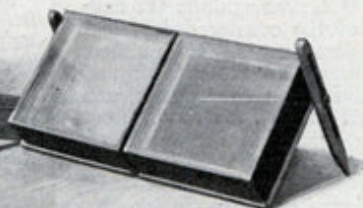
POWER FROM ANY WIND

This is a model demonstrating the plan of Peter Bendmann for a pair of huge wheels which adjust themselves to face the wind

New Efforts May



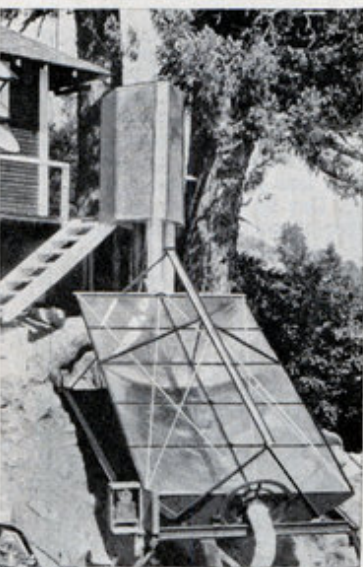
Research worker in Russia making electrical measurements of the sun's energy as part of Soviet's program to harness the sunlight



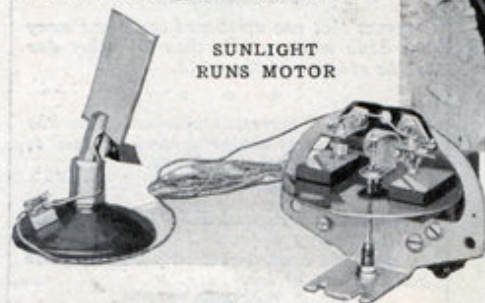
This bank of solar boilers has been installed by the Soviet Government at Tashkent in central Asia where efforts are being made to capture the sun's energy



Model of the fifteen-foot solar furnace recently completed at the California Institute of Technology. Mirrors are used



SOLAR COOKSTOVE
Built by Dr. Abbot on Mt. Wilson, California, this solar cooker uses an aluminum reflector to direct the sunlight upon a pipe containing cylinder oil. The heated oil is then used to warm the ovens. In general enough heat is generated to cook all foods



A combination of metals in the plate at left turns sunlight into electricity. In this way sufficient power is captured to run a small motor. This is a German method for power

SUNSHINE, our greatest source of potential power, is now largely wasted. It is highly probable, however, that a few years hence science will find a way to harness the mighty energy of the sun's radiation. Solar engines and solar heating apparatus will then make it economically practicable for us to use at least a small portion of our now-wasted sunshine to run our factories, light our streets, cook our food, and warm our houses.

In the United States we use, each year, something like a half billion tons of coal, a half billion barrels of oil, and fifty billion horsepower hours of water power for heat, light, and power. If it were possible to convert all this energy into power—which of course it isn't—it would produce seven trillion horsepower hours. If it were possible to convert completely into power all the solar energy that each year falls on the United States in the form of sunshine, it would amount to seven thousand trillion horsepower hours. Of course, some of the sunshine that comes to us through 93,000,000 miles of space is needed for the general heating of the earth and for the growing of plant life; but above those fundamental needs, solar radiation provides a potential supply of power many thousand times as great as the amount now supplied by other sources.

Solar radiation experts estimate that the sun emits 12,500 horsepower of energy for every square foot of the 585 billion square miles of surface it exposes to the earth. By far the greater part of this almost unthinkable amount of power is lost on its long journey through space, but the radiant energy that reaches the outer surface of the earth's atmosphere is equivalent to 7,300 horsepower per acre, and at noon on a clear day 5,000 horsepower per acre is transmitted through our atmosphere to the land surface of the earth. The theoretical power value of the sunshine that falls on the 133 square miles of the city of Philadelphia is equal to the power that could be generated by a hundred Niagaras. The Sahara Desert, in a single day, receives solar energy equal to the power that would be produced by burning 6,000 million tons of coal.

No one thinks that it ever will be possible to convert into mechanical power anything like all of the theoretical power value of the heat reaching the earth from the sun. Steam boilers and steam engines have been built for a good many years now, but no boiler or engine has been built that can convert all the heat of coal into its theoretical equivalent of actual power. The heat value of good coal equals 12,760 horsepower hours a ton, but the best result ever obtained from a ton of coal with a boiler and steam engine is 1,470 brake horsepower hours, 11.5 per cent of the fuel's heat value.

That the use of solar radiation for power is no vague dream of the far-distant future is shown by the fact that at present a solar power plant with a thermal efficiency of 4.32 per cent—over one third of the efficiency of the best steam engine—has been built and is being operated.

Dr. Charles Greeley Abbot, the secretary of the Smithsonian Institution and the world's leading authority on solar radiation, says that before

Harness SUNLIGHT

By ROBERT E. MARTIN

long we shall find a commercially practicable method of harnessing sunshine. "Financial success probably awaits the solver of the problems of collecting solar heat for power purposes," he says. "With our present outlook it seems to me likely that within another generation or two power demands will lead to the sun as the most available source of supply."

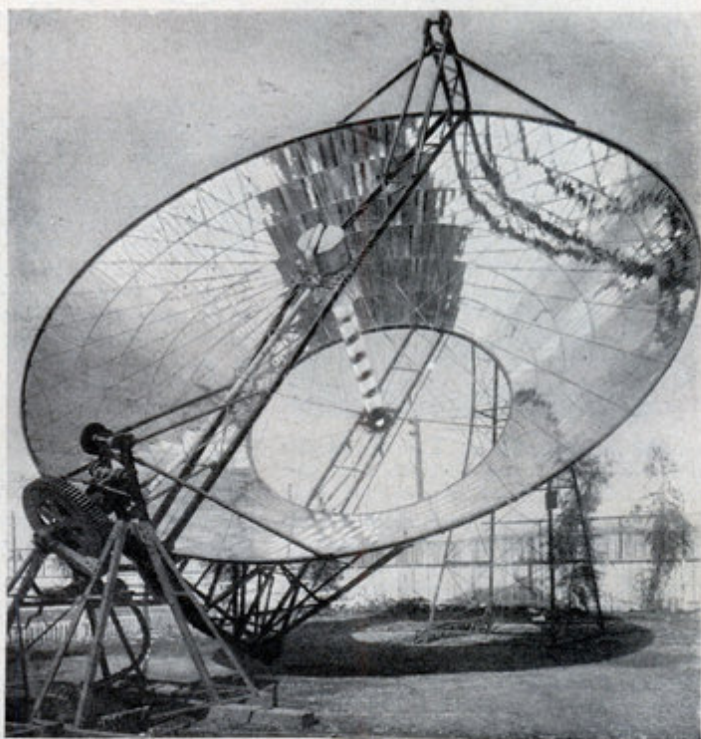
Over 2,000 years ago, a few wise men knew enough about solar radiation to concentrate the sun's rays for their own benefit. Among them were the pagan priests of ancient Rome, who occasionally allowed the sacred fire in the temple of Vesta, the Goddess of the Hearth, to go out, and then rekindled it by placing a piece of carefully dried wood in the focus of a conical metal reflector and letting the sun do the rest. Also there is a classical story that the famed philosopher Archimedes, when a Roman fleet was attacking Syracuse in 214 B.C., set fire to the Roman warships by concentrating sun rays on them by means of mirrors erected on the shore.

It was in an effort to prove the possibility of this tale that, in 1747, Buffon, a French naturalist, made the earliest known scientific experiments leading toward the utilization of solar energy. He mounted over 300 small glass mirrors on a frame so that each of them could be adjusted separately, and so that all of them could be made to concentrate their rays at any desired distance. With this apparatus he set fire to wood over 200 feet away, and melted silver at a tenth of that distance. A few years later Hoesen, a mechanic of Dresden, built a mirror ten feet in diameter whose concentrated rays almost instantly melted coins. To-day, almost two centuries later, scientists still are interested in burning glasses. Dr. George E. Hale, astronomer at the Mount Wilson Observatory in California, recently designed a fifteen-foot instrument with thirty lenses that generates a temperature of 6,000 degrees centigrade that melts steel wire as fast as an ordinary gas burner would melt butter.

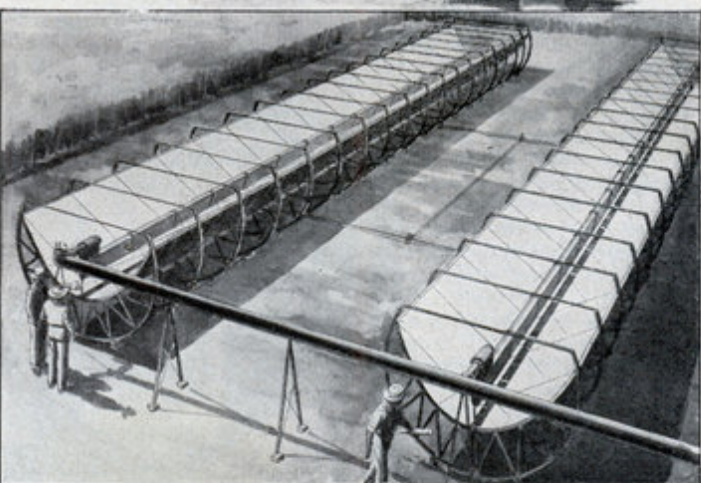
About twenty years after Buffon's experiments, H. B. de Saussure, a Swiss scientist, invented the solar hot box. Realizing that it is not until the sun's radiant energy strikes some material object that it is converted into heat, and that black, which absorbs all of the sun's rays, is the most efficient color for this conversion, he constructed a small wooden box, painted it black inside, and covered it with two sheets of plain glass with an air space between them. Just how high the temperatures were that he obtained in this box when he set it in the sun is not known, but when, in 1837, Sir John Herschel used a similar box in Cape Town, a thermometer in it registered 240 degrees Fahrenheit. Sir John astonished his neighbors by using his apparatus for the homely purpose of frying eggs and stewing meats and vegetables. So it seems that his crude hot box was a sort of rough draft of the solar cooker that in recent years Dr. Abbot has developed to a high degree of efficiency.

De Saussure and Herschel had been content to prove that it was possible to collect the sun's heat. In 1874, August Mouchot, a brilliant French engineer and the greatest of the pioneer harnessers of the sun, took a long and bold stride forward. He used concentrated reflected sun rays to generate steam in a boiler, and used that steam to operate a small engine.

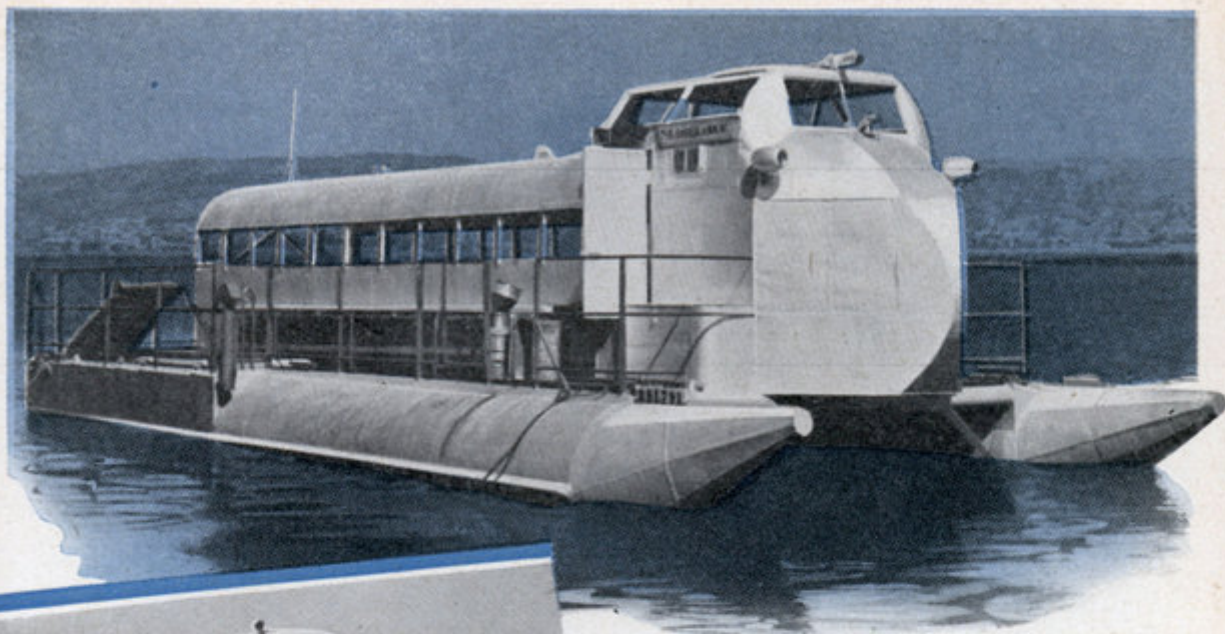
Mouchot's apparatus, the first solar power plant, consisted of two principal parts—a reflector and a boiler. The reflector, a truncated copper cone lined with thin silver leaf, looked like a big lamp shade pointed skyward. It was thirty-two inches deep, had a diameter of forty inches at its base, and a diameter of 102 inches at its mouth. A hand-operated (Continued on page 112)



This strange looking machine is a solar engine erected at Pasadena, Calif. The ring of mirrors concentrates sun's energy and the outfit is reported to have produced about four horsepower



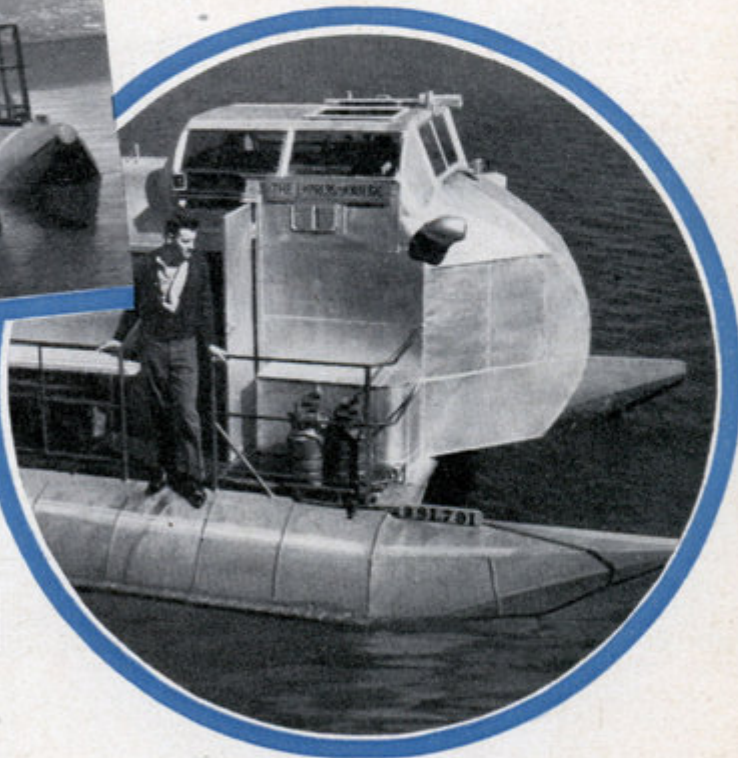
At top, heating water with a solar boiler at the Soviet's experiment station at Tashkent. Above, view of the most successful solar power apparatus thus far made. It was erected near Cairo, Egypt, and uses boilers placed at focus of horizontal reflectors



Looking like a bus on skates, this novel craft was designed for carrying parties of anglers



Nose-on view of the pontoon boat. Right, note railing on the float



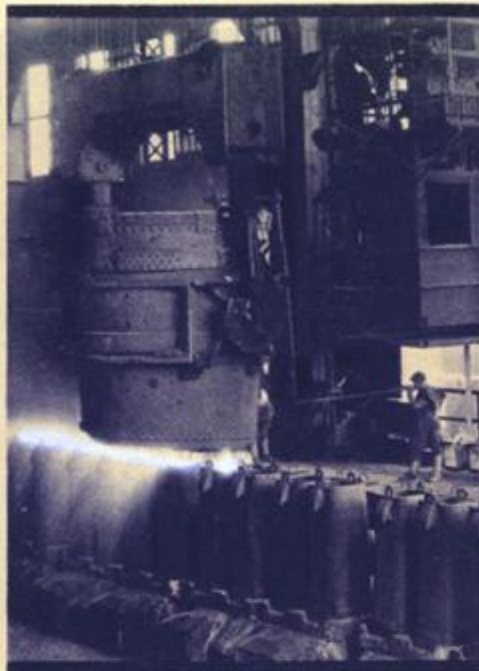
Pontoons Support Odd Fishing Boat

PONTOONS made of welded sections of steel float a unique boat constructed by students in an Oakland, Calif., school of welding for use as a fishing craft for large parties of anglers on San Francisco Bay. Powered by two 110-horsepower gasoline engines, one installed in the stern section of each pontoon, the odd boat will have a speed of about twenty knots. The supporting pontoons, each thirty-nine feet long and with a

twelve-foot circumference, are made in fourteen separate air-tight compartments, and are joined together by a welded truss made of six-inch pipe. Behind a raised, inclosed control bridge, the coachlike weatherproof cabin has accommodations for thirty passengers, who are able to fish from a rail-protected deck over the pontoons. Three views of the unusual craft are given in the photographs reproduced above.

The
STEEL
of the **FUTURE**

TAPPING a blast furnace. The molten metal flows down a winding trough and into a huge ladle car which transports it to the open hearth furnaces.



LEFT, the melter, the sentinel of steel, watching from his platform as an open hearth furnace is tapped and 150 tons of molten iron rushes into the ladle. **Center**, filling ingot molds with molten metal from a huge ladle which moves down the long row of molds. **Right**, fingers of a giant crane lifting a cherry-red ingot from the soaking pits. From here the ingot goes to the roll train and the "blooming mill" rolls it into a long slab.

F

By
H. W. Magee

FROM bronze to iron, from iron to steel, and now a new era—that of steel and its alloys—such is the story of human progress.

Before the Napoleonic wars, this was a world of hard labor. Then came steam to lighten toil, and to lift loads off men's backs.

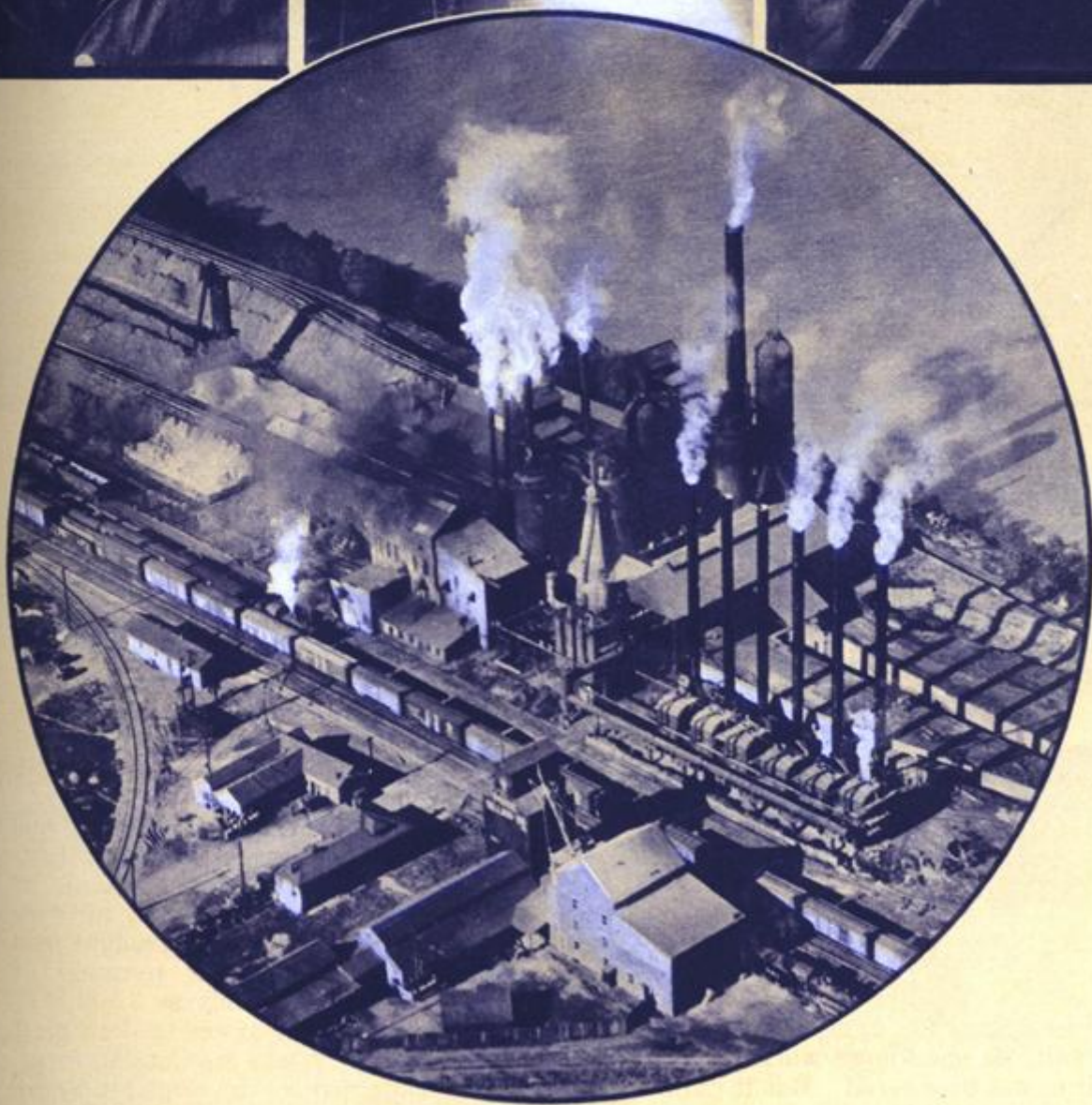
Iron supplanted bronze. Steel displaced iron because it was stronger. Certain kinds of alloys today surpass ordinary steel in physical properties—strength, toughness, hardness, resistance to oxidation, the action of chemicals, stability at high temperatures, electrical characteristics and luster.

The physical properties and characteristics of steel can be changed in an

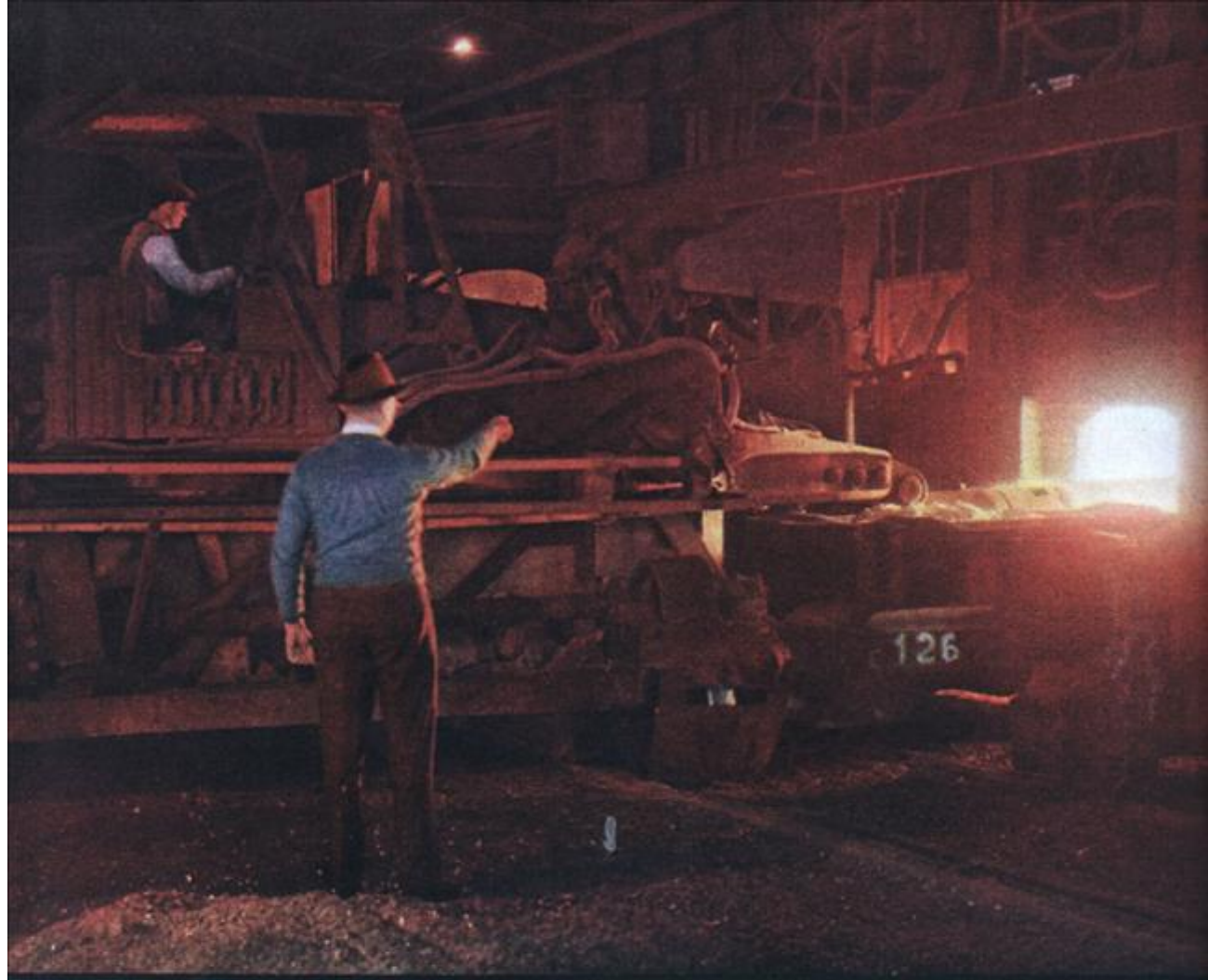
endless variety of ways not only by combining it with other metals but also by applying heat. Heat treatment gives almost as much promise for future growth in the uses of steel as do the developments of its alloys. Steel is alive. By heat alone, it is possible to change the two ends of a steel bar so that each has entirely different characteristics. The heat treatment of metals is still one of the great unexplored fields of science.

There are almost as many kinds of iron and its alloys today as there are uses for iron and steel products, and the number is constantly increasing. Your automobile, for instance, contains about forty different kinds of iron, steel and steel alloys, and those in your car may be entirely different from the metals with an iron base employed for thousands of other purposes ranging all the way from massive machinery to domestic cooking utensils.

To realize the possibilities of these new alloys, we must first know some of the properties of the mother metal, iron. While iron and iron products form the



BLAST furnace of the American Rolling Mill Company. Above, steel worker peering into open hearth furnace, a white-hot slab ready to start through the continuous rolling mill, and steel worker cutting slabs into three-foot squares in preparation for rolling into sheets.



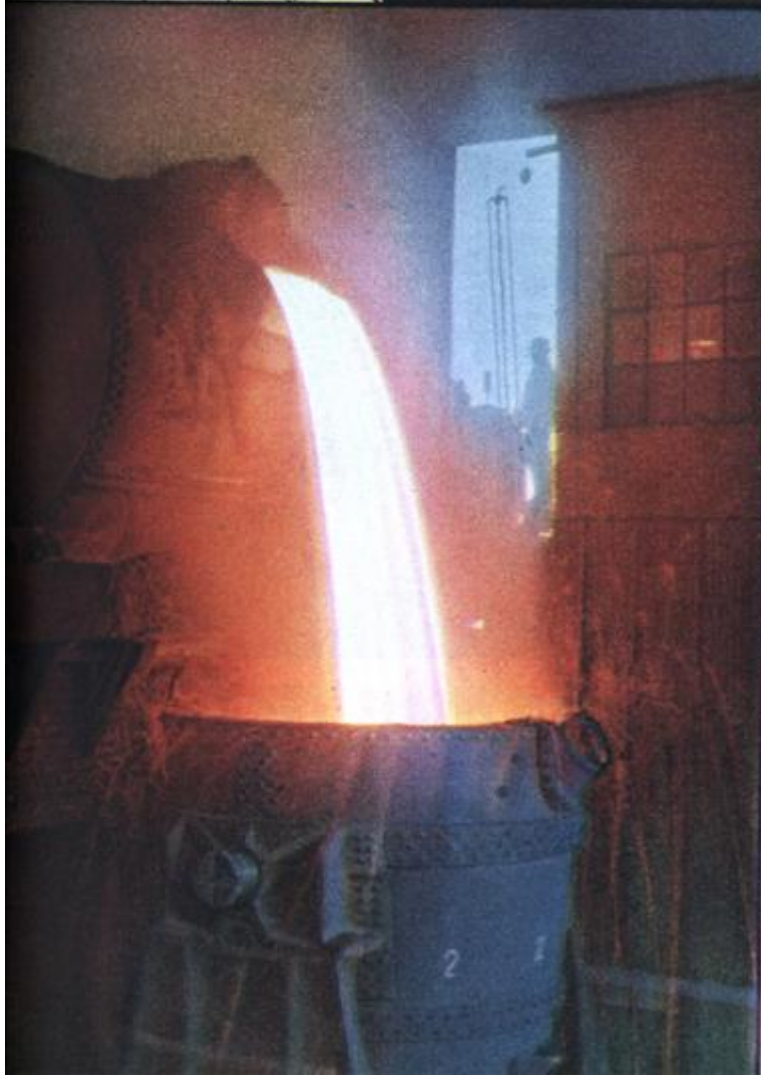
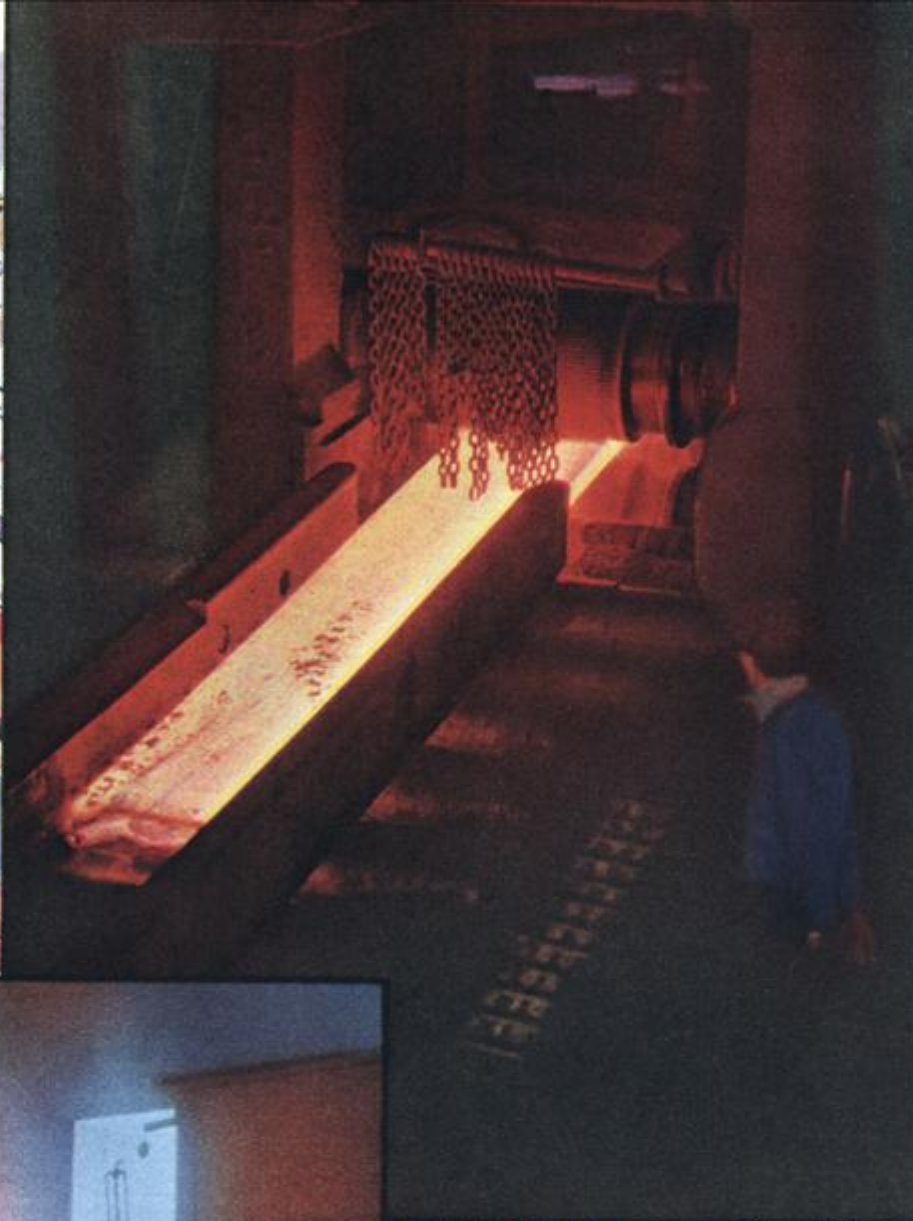
base upon which our civilization has been built, no one knows when or by whom iron was discovered. But it did have to be discovered because there are no nuggets of pure iron. Perhaps some early aborigines built a roaring fire against a bank of reddish earth consisting partly of iron ore. The prevailing wind served

CHARGING an open hearth furnace. Heat is generated by hot gases forced through checker chambers under pressure and temperatures of 3,000 degrees are not uncommon.

as a bellows to blast the hot flame against the bank. When the fire died out, they poked about among the embers and found a few pellets of malleable substance which made a very superior spearhead. Some such accident must have ushered in the iron age.

At any rate, the neolithic genius who "doped out" the secret seems to have spread the news, for the remnants of ancient furnaces are scattered all over the world, and a wedge of wrought iron was buried in the great pyramid of Cheops probably as early as 3,500 B.C. The real forerunner of our modern blast furnace, however, was the Catalan forge, a very crude furnace developed in Spain some 150 years before Columbus discovered America. It burned charcoal and used a blast of hot air to smelt a malleable iron.

Some of the troubles of these early

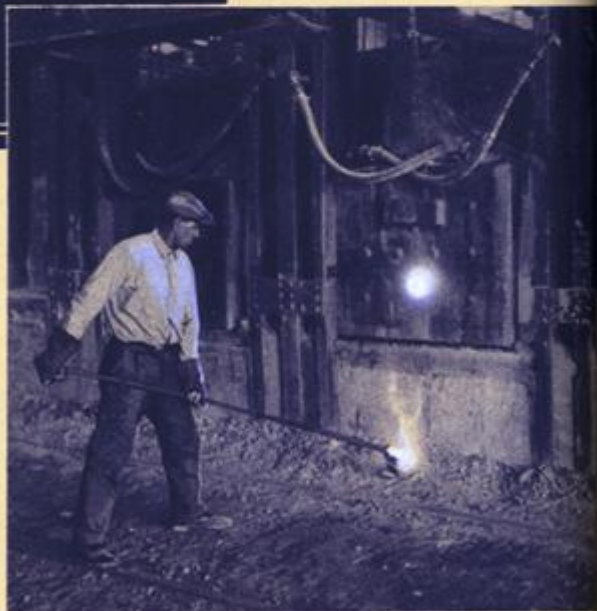


PONDEROUS ingot, above, being passed back and forth through mighty rolls to reduce it to a twenty-foot slab. Left, stream of molten metal spilling into ladle from "hot car."

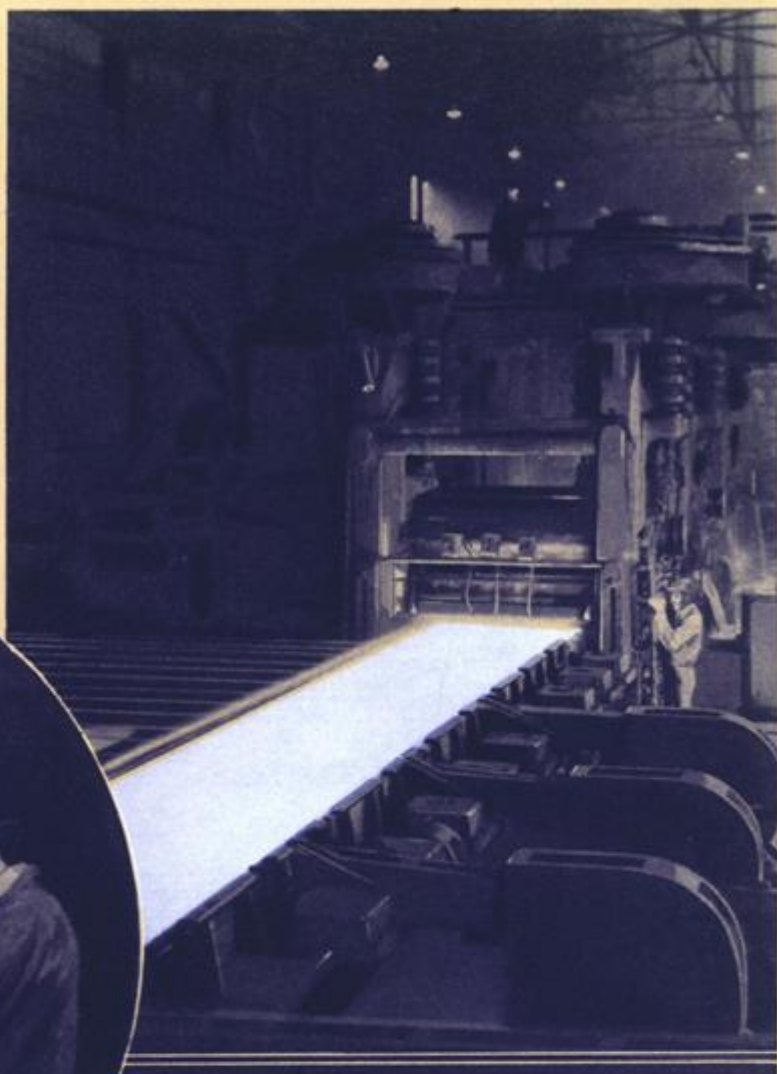


metal workers are explained by the very nature of iron. Iron ore is a natural deposit consisting of the iron held in the chemical grip of oxygen. Under the influence of high heat, oxygen's strangle hold on the metal can be broken by carbon. The first primitive furnaces produced a small ball of metal, soft and malleable, a variety of wrought iron.

Then a great discovery was made—a discovery which affected the future of civilization. It was found that when more charcoal was present in the furnace than was necessary to combine with the oxygen of the ore, the liberated iron absorbed enough of the excess carbon to change its own nature. The intense heat produced a fluid metal in the hearth of the furnace instead of the stiff, pasty ball of malleable iron. It also was found that this liquid iron could be "cast," or poured into molds and made into shapes useful to man, so it became known as



LIFTING steel sheets from the roll table in the finishing mill as the morning sun streams in through the windows and, below, dipping a sample of molten metal from the open hearth furnace to be sent to the laboratory for analysis.



A RIBBON of steel as it speeds through the continuous rolling mill and, at left, the end of the journey through the mill. The man is measuring the gauge of the red-hot coil.

cast iron. That was a great stride forward in the iron age—the knowledge that a surcharge of three and one-half to five per cent of carbon gives iron a fluid quality while hot and an extreme brittleness when cold.

Next came steel, the master servant of mankind and the first alloy of iron. Steel has neither the softness of malleable iron, which is low in carbon content, nor the hard brittleness of cast iron which is high in carbon content. The early metal workers made very fine sword blades by heating rich ore in small closed crucibles,

allowing the metal to absorb about two per cent of carbon instead of the three and one-half per cent or more of cast iron. The result was carbon steel. When hardened by cooling quickly in water, a forged-out blade of this material could cleave a piece of iron without dulling its edge or cut in half a piece of silk floss tossed into the air.

The triumvirate of wrought iron, cast iron and steel formed the basis of the iron and steel industry. As civilization advanced, the world needed more and more iron and from this need there

Rubber from the SUN

Amazing experiments conducted on the American desert point the way toward the day when the sun will be the universal source of power for industry—and also the manufacturing source of rubber, nitrates, and other organic compounds. This authentic article explains how such results were achieved, and describes probable future developments.

SOME day your automobile may run on rubber tires manufactured from sunlight. And some day, too, that same automobile may be driven by a solar motor, deriving its power from the energy stored up in the sun's heat rays.

Astonishing as these statements may seem, they follow very naturally out of a series of amazing experiments conducted last summer by Dr. J. W. D. Chesney of Maywood, Illinois. Dr. Chesney is a recognized leader in this fascinating branch of science, having worked with sunlight for many years, developing a number of processes on which he holds basic patents.

How can rubber be produced from the sun? The method is explained later on in this article; the diagram on page 63 illustrates the principle. Rubber is only one of the items which Dr. Chesney proved can be manufactured with the aid of sunlight. On a laboratory scale he succeeded in making chloroform, carbon tetrachloride, and other substances through the action of sunlight on natural gas.

The idea of a sun motor is not new to Dr. Chesney. For years scientists have realized that millions of dollars worth of power is being wasted every minute in the untapped solar rays which strike the earth.

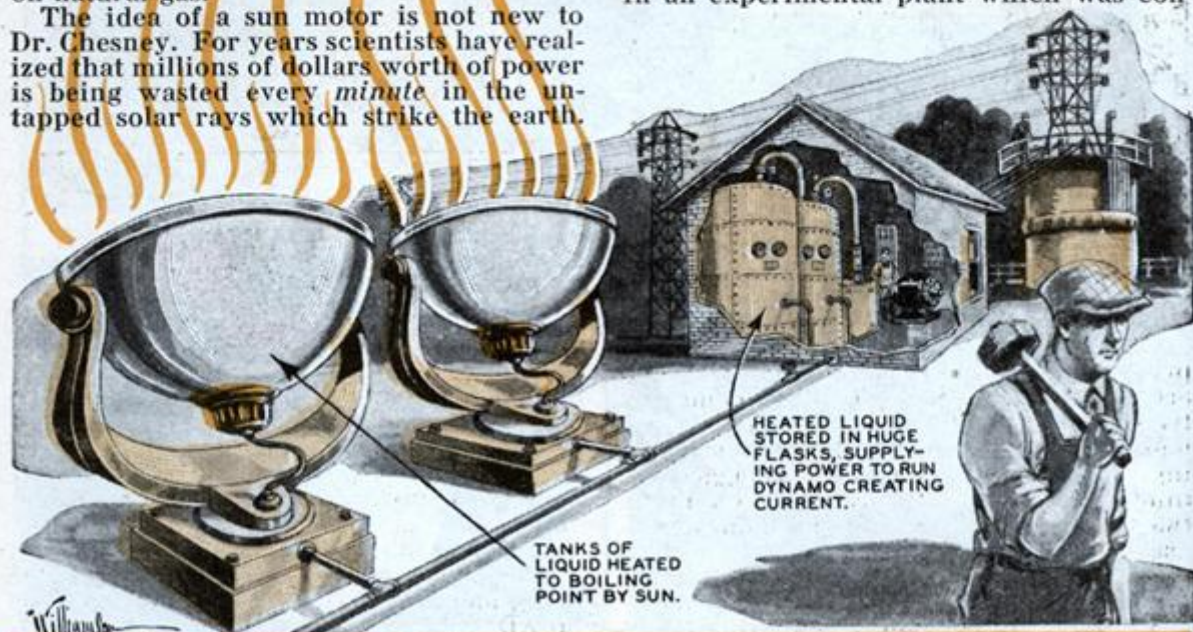
Using a sun motor only 10% efficient, the state of Arizona could furnish twice the amount of power obtained in the United States from coal, oil, and water.

If this seems an exaggeration, look at the photograph on the opposite page, which shows Dr. Chesney's four-foot sun mirror, reproduced on this month's cover, in action. The sun's rays, concentrated by the mirror into a three-inch disk, burned through a piece of sheet metal in a few seconds.

Storage Method Is Problem

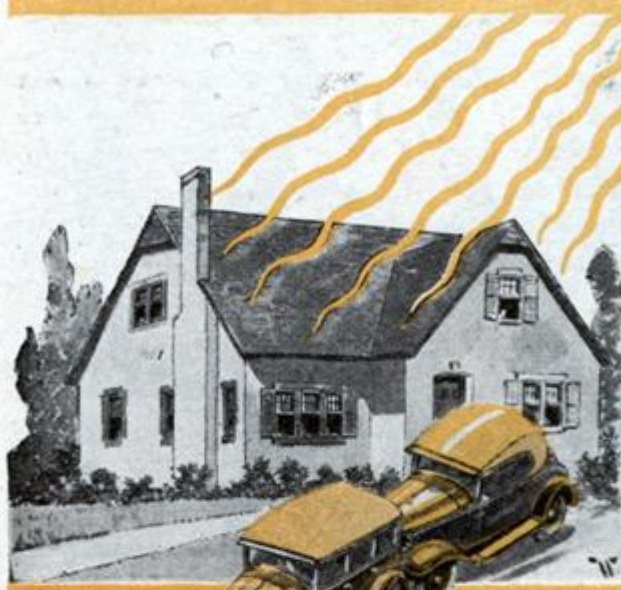
The greatest difficulty in the utilization of solar energy for power lies in the lack of suitable storage methods, so that energy can be piled up for use on rainy days and at night. This is by no means an insurmountable difficulty. Dr. Chesney proposes a system in which certain liquids of high boiling point are heated by the sun and the heated liquid stored in modified Dewar flasks, to be called on as needed.

There is nothing fantastic in this idea. In an experimental plant which was con-



One method of storing solar energy, which has proved successful in tests, is suggested by Dr. Chesney. Tanks of liquid of high boiling point are heated by the sun and the hot liquid stored in insulated flasks, from which it can be withdrawn as needed to convert water into steam to drive electric dynamos. Mirrors concentrate sun on liquid.

-and POWER Too!



220 horsepower, equivalent to that of four motor cars, is the average amount of solar energy radiated to the roof of a bungalow.

structed, thin metal tubes were passed through the hot liquid. When water was poured through the tubes, heated by the liquid, it was transformed into steam.

Still another storage method would be to convert solar radiation into thermo-electricity by concentrating sunshine on hot junctions and charging storage batteries. This stunt has actually been done in Chicago. Sunlight concentrated on hot junctions, 100 pairs, produced enough electric current to charge a 6-volt storage battery or to run an electric motor which operated small toys.

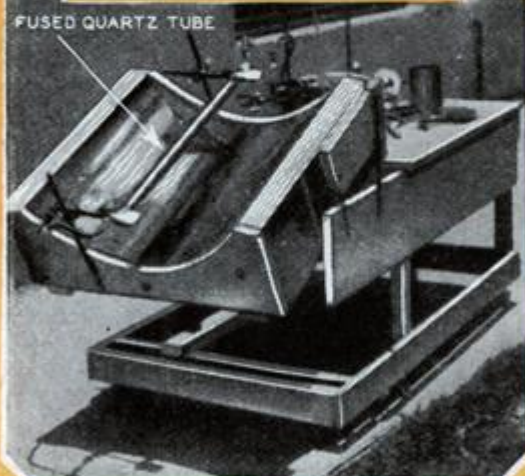
Sun Generator Will Come

The world awaits a thermo-electric generator; some day it's bound to come, for present sources of power—coal and oil—are definitely limited. Within a comparatively few years they will be entirely exhausted. Considering these facts, it is amazing how scientific research has lagged behind in this field. Dr. Chesney is convinced that if a small fraction of the money now used in attempts to smash the atom were expended on sun power development, the power question would be forever solved.

Suppose, for instance, that you could harness and store the sunshine that falls on the roof of your home. Assuming that you have an average bungalow, 30x40 feet, the



Dr. Chesney's sun mirror burned a hole through sheet metal in a few seconds, demonstrating power of rays.



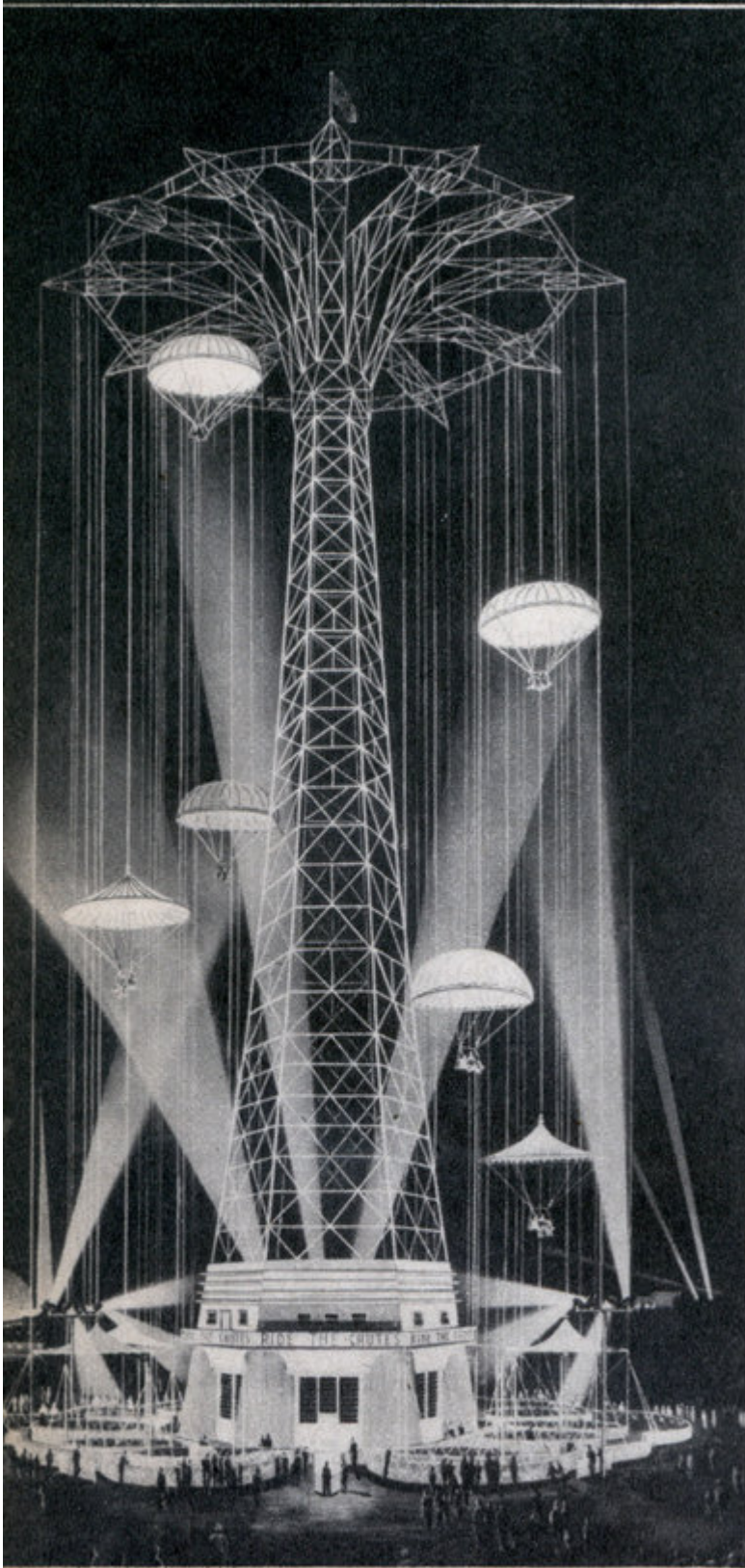
Apparatus used in manufacturing rubber and other compounds. Quartz tube is used because it permits ultra-violet rays of sun to pass through it, acting on the chemicals inside.

amount of sunlight that falls on the 133 yards thus represented equals 220 horsepower—roughly equivalent to the power of four average motor cars, as illustrated in the accompanying drawing. Why, then, are you buying coal, gas, and electricity?

No less interesting than the power possibilities of the sun are its photosynthetic abilities (meaning the capacity of building up compounds with light).

We have already mentioned rubber as being manufactured in this way. Let's see how Dr. Chesney did it. First he constructed a chromium-plated cylindrical reflector, illustrated herewith, which concentrated the sun's rays on a fused quartz tube. Quartz

Sensational THRILL RIDES



Two in a seat, securely strapped-in. These precautions make the parachute jump safe for all.

HOW would you like to experience the thrill of a parachute jump—without the accompanying dangers of the 'chute failing to open, of being blown out to sea or of landing in a tree? Well, that thrill will be yours if you are one of the lucky 60,000,000 expected to visit the New York World's Fair after it opens on April 30. As a matter of fact, a safe parachute jump will be only one of the many sensations ingenious engineers have invented for the Fair visitor's amuse-



Something new in thrill rides awaits those who take the 250-foot parachute jump from this spectacular tower specially designed for the World's Fair. Instead of hitting the ground with a thump, the fall will be "broken" by special rubber cushions atop four poles illustrated at right. Spring suspension softens the landing.

Biggest Post Office

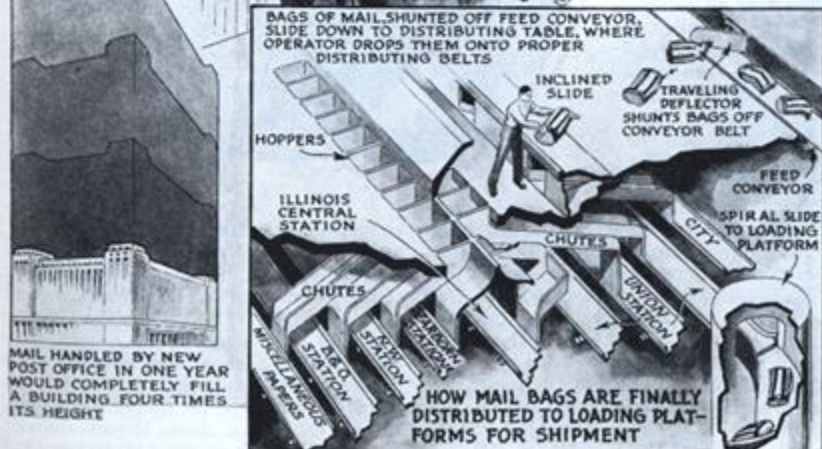
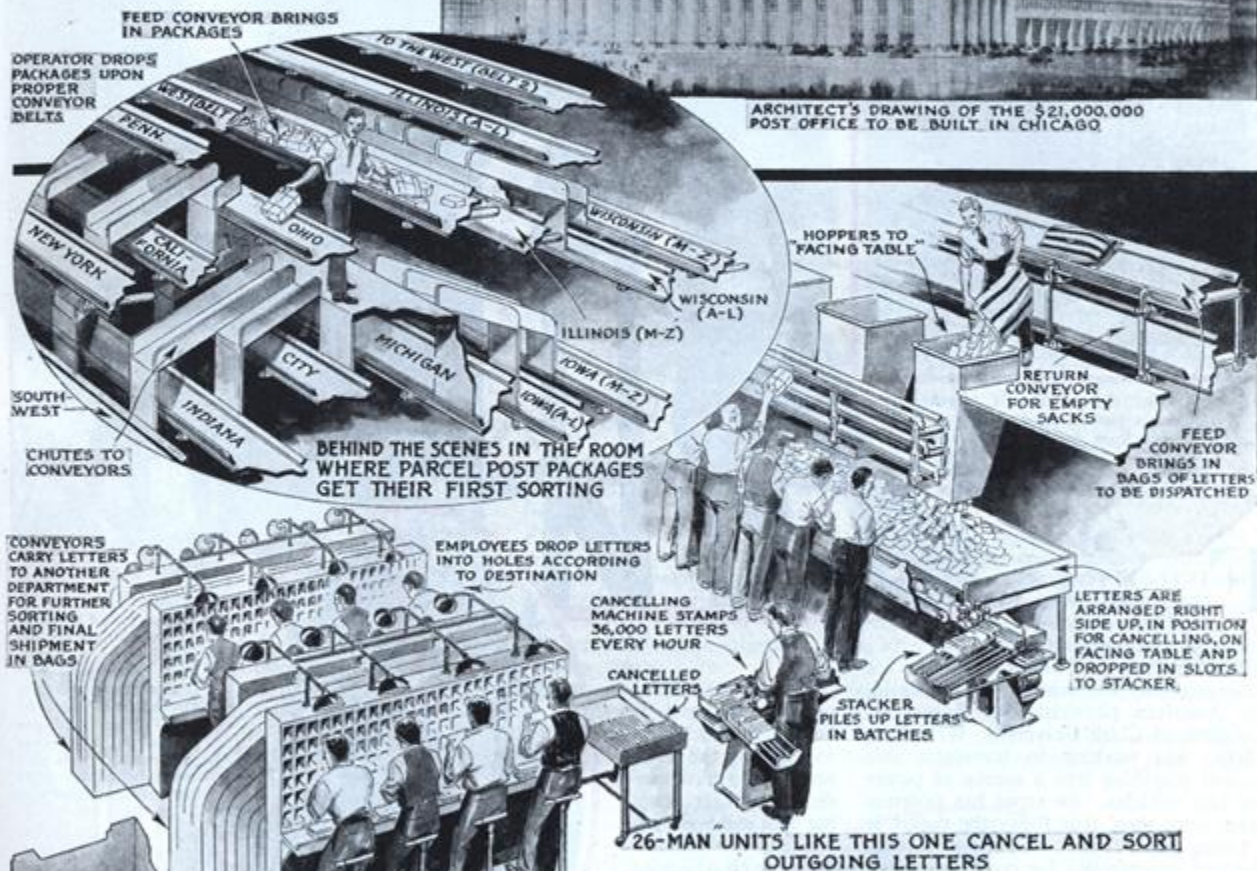
TO BE BUILT IN CHICAGO

CHICAGO is to have the largest post office in the world. The fifty-acre, twelve-story building will be completed and ready for occupancy within about a year and a half, according to a recent announcement of the United States Post Office Department. It will be able to care for the 19,000,000 letters a day expected by 1943, in addition to the parcel post packages and newspapers. In one year, it is estimated, the total amount of mail handled would be sufficient to fill completely a structure four times its size.

More like a factory than a post office



ARCHITECT'S DRAWING OF THE \$21,000,000 POST OFFICE TO BE BUILT IN CHICAGO



are the workings of this structure. Motor trucks, one every minute, will bring in letters from collection boxes throughout the city. These letters will be shot upward in elevators to the upper floors, and travel by gravity down through the building. By the time they reach the ground floor they will be canceled, sorted, and ready for dispatch by train or airplane. On this page our artist shows some of the mechanical devices behind the scenes that will speed letters.

In the parcel post room, for example, an attendant drops packages from a main belt upon conveyors that classify them by states. Where the volume of mail requires two conveyors for one state, mail for cities with the initials "A" to "L" goes on one belt, and "M" to "Z" on the other.

OUTLAWS MAY USE

by MURPHY McHENRY

RADIO circles on the Pacific Coast were turned topsy turvy not long ago by the continued presence of a radio pirate ship which had taken unto itself a very popular spot on the dial and started broadcasting without regard for the land stations with which it interfered.

The primary purpose of the unlicensed broadcast station was to advertise the gambling, liquor, and other dubious pleasure activities of the ship upon which it was built—all these activities beyond the 12-mile limit, of course. Thousands responded to the advertising and the owners waxed rich. They found other sundry rackets, such as a fortune telling program, which brought in additional money and finally assumed such an extensive program that one Los Angeles station was threatened with a complete loss of audience and business because the ship's radio signal was the more powerful of the two.

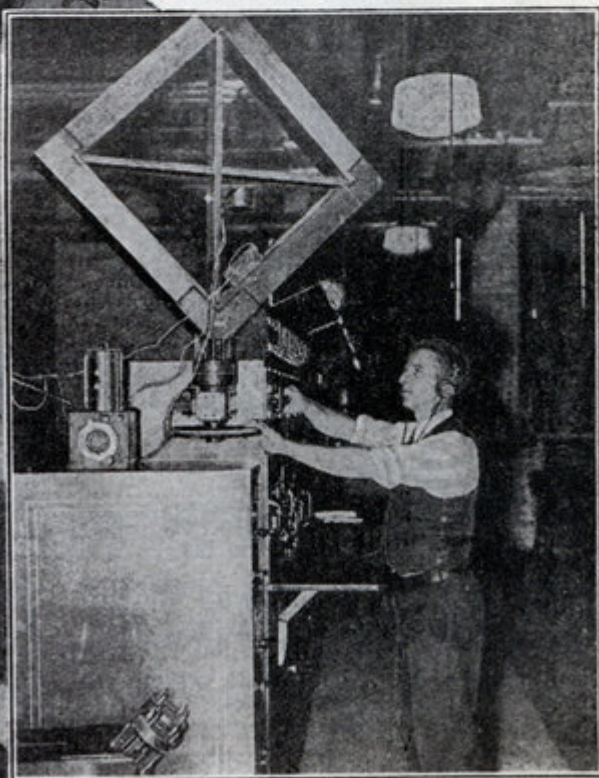
After numerous unsuccessful attempts of a local nature, the floating broadcasting establishment was silenced, but only after the state department at Washington, D. C., had made diplomatic representations which forced a Central



U. S. Radio inspectors are here shown as they check on outlaw stations, gathering evidence to prove that their waves are carried beyond state boundaries.



Map showing locations of several stations just across border in Mexico. Gulf of Mexico, to which several stations may be driven, is also pictured. XEPN's balloon aerial blew away.



This is one of the several super-sensitive directional antennas used by officials of the federal radio commission to keep a constant check on the hundreds of radio stations in the U. S.

SUPER-STATIONS at Sea

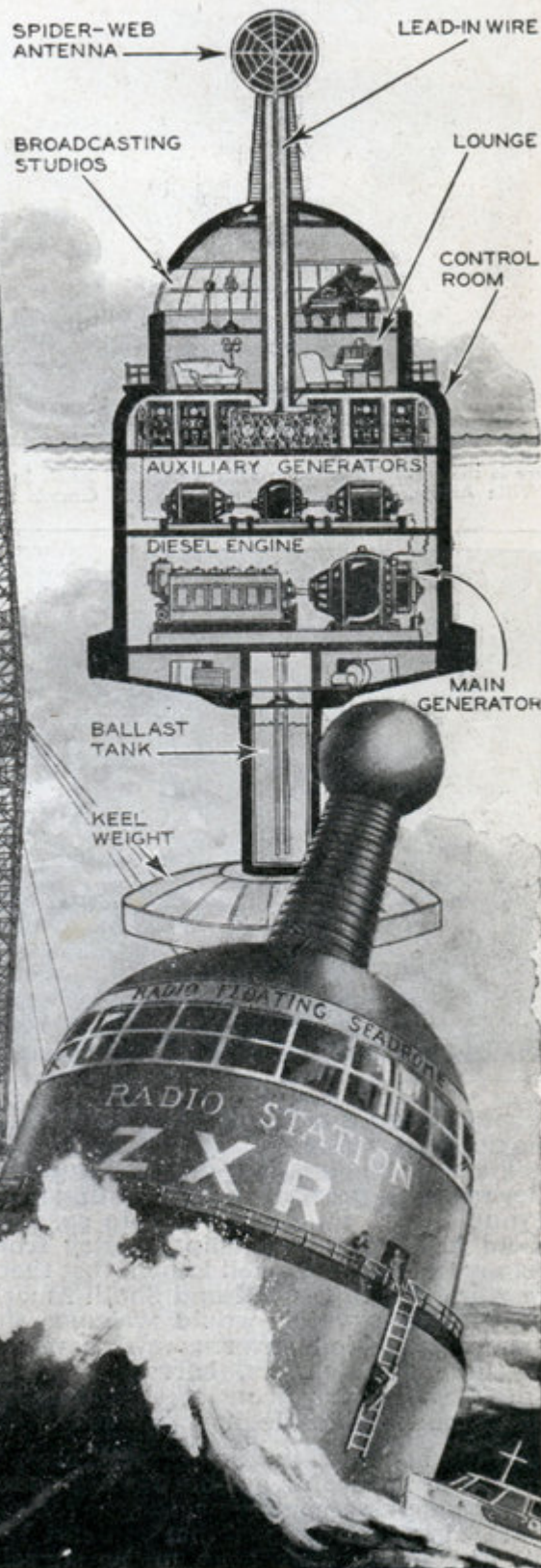
Broadcasting stations without a country seek new ways to flood the United States with radio advertising barred by federal commission. Two hundred outlaws face war by the government.

American country to cancel the ship's registry.

However, this ship had paved the way and now, with the United States making headway in its fight to muzzle stations just south of the Rio Grande river, within the shelter of Mexico, it appears that soon floating broadcast palaces may be dotted here and there outside the 12 mile limit, particularly in the Gulf of Mexico.

There is little chance that the border broadcasters will give up without a struggle. Led by XER's spectacular Dr. John R. Brinkley, formerly of Milford, Kansas, and now of Del Rio, Texas, they have found too many ways to gather in otherwise hard earned dollars to sit by complacently and be permanently hushed. Dr. Brinkley has made millions of dollars as a result of his broadcasts. Others, working along numerous lines, have taken in many more millions.

And that is why, in the face of possibilities that they may be driven out of Mexico, these promotional minded broadcasters

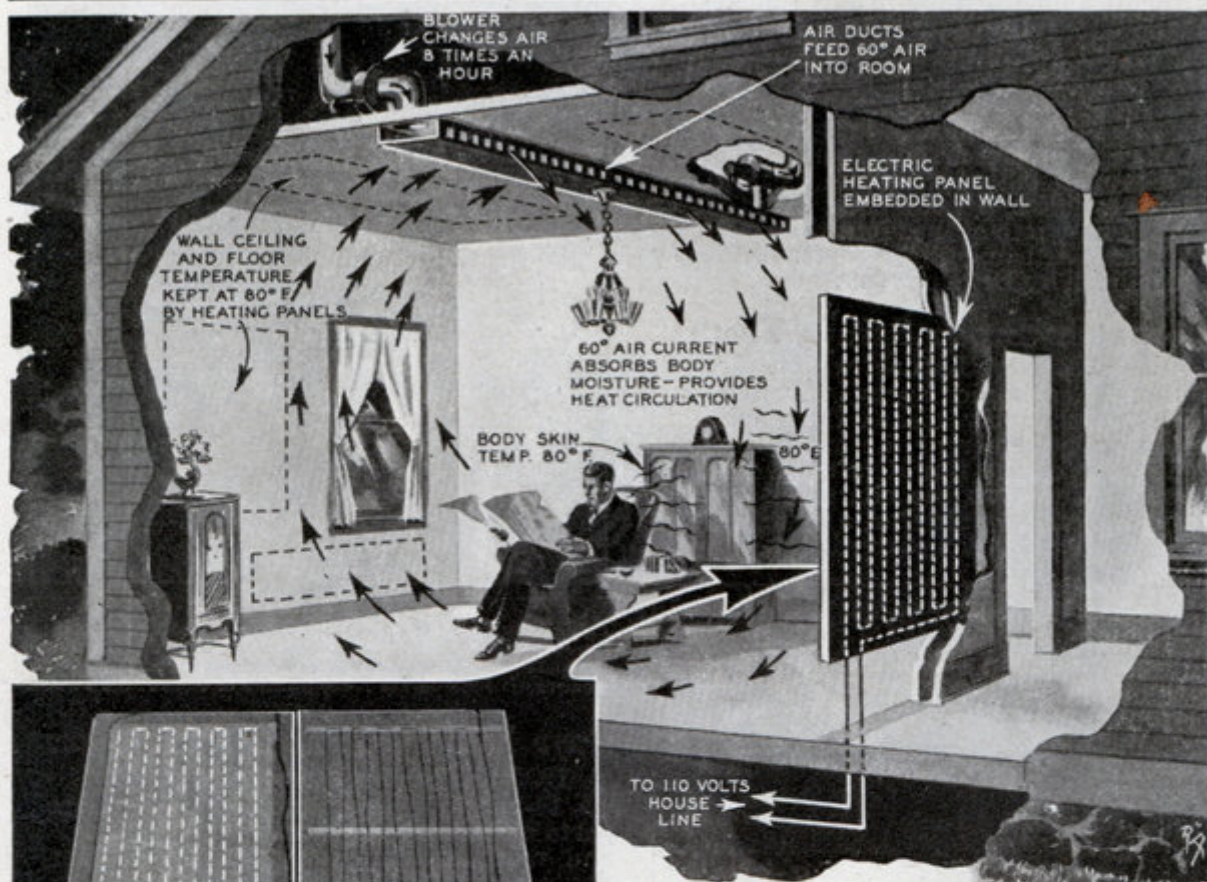


This plant will house new 500,000-watt transmitter of WLW, Cincinnati. Note vertical antenna.

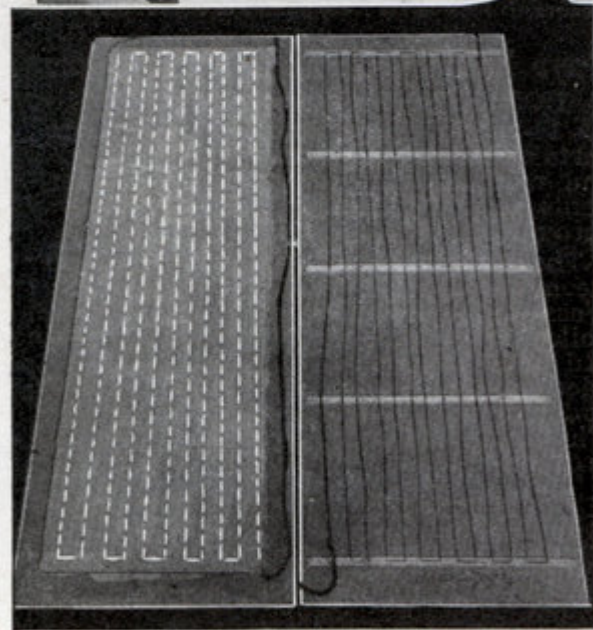


Here is the artist's conception of how the broadcasting stations now proposed for sea use may look. Water forms a perfect ground for broadcasting purposes and it is freely predicted that outlaw stations, those denied the privilege of broadcasting on United States soil, would attain even greater coverage if they had proper equipment anchored outside the 12-mile zone on the Gulf of Mexico. Below, left, are seen several of the huge new tubes which will be used in feeding 500,000 watts power into WLW's antenna. Outlaws are already planning to compete with this huge output.

Ultra-Modern Homes Promise



Invigorating indoor climate is created by circulating current of 60° F. air through room heated to 80° F. by wall panels.



80° F. heat is radiated into the room from panels of this type embedded in walls, floor and ceiling, as shown. Dotted lines show position of wires when covered by plaster.

A NEW architectural age is dawning! Proof of this is seen in the strange new types of homes which are springing up throughout the country, presaging the day when we will be living literally in glass houses.

Our faithful old wooden and stone dwellings are primitive and unscientific, not so very far removed, so far as comfort and convenience is concerned, from the caves in which our half-human ancestors dwelt,

say exponents of the new housing era.

Bouncing health and inexpensive comfort are the goals towards which home designers are striving. No more muggy rooms on torrid summer days; no more dry, over-heated rooms on cold winter days. Plenty of health-giving sunlight shining through glass walls and plenty of terrace space for sun bathing and al fresco dining.

An amazing new method of heating your rooms in winter time by means of a forced draft system operating in conjunction with heating panels embedded in walls is the contribution of heating and ventilating engineers to increased home comfort.

As illustrated in an accompanying drawing, the walls, floor and ceiling of the rooms are kept at a temperature of 80 degrees F. by the wall heating panels. In the ceiling, a row of air ducts circulates through the room a current of air cooled to 60 degrees F.

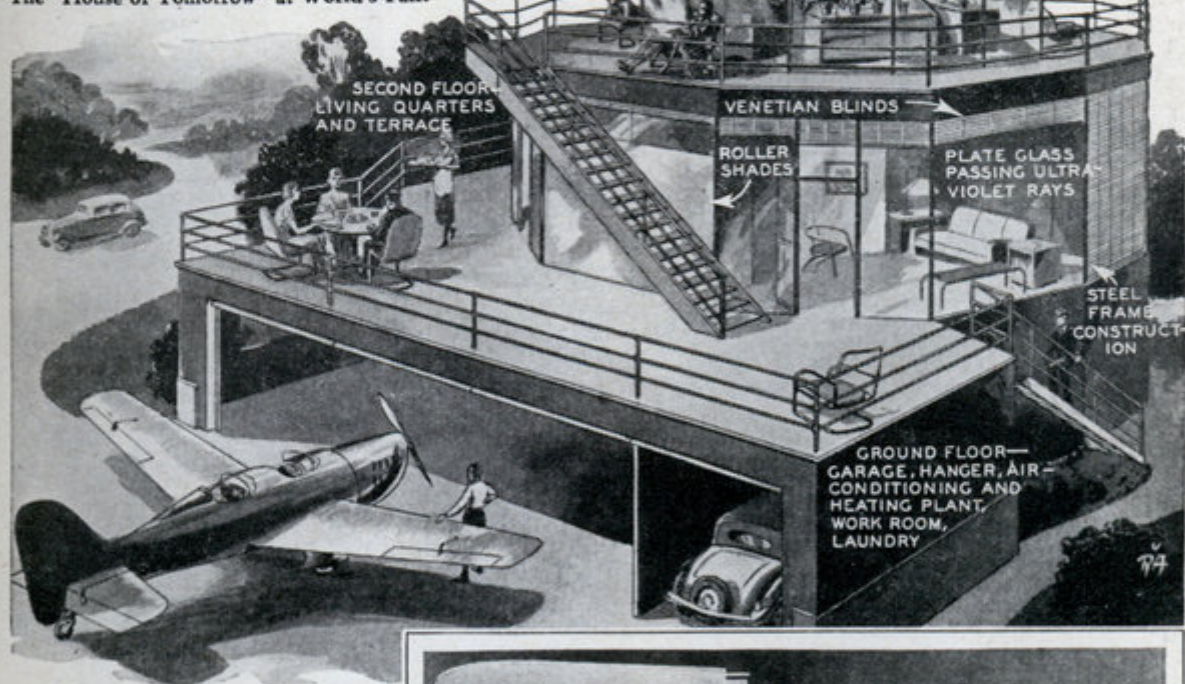
Now bodily health and comfort demand that the heat generated by the ordinary processes of life be dissipated. With the wall temperature kept at 80 degrees F., this dissipation is prevented, so it remains for

Better Health and Comfort



Sheet steel walls welded to steel girder frame replace wood and stone in this ultra-modern home.

The "House of Tomorrow" at World's Fair.



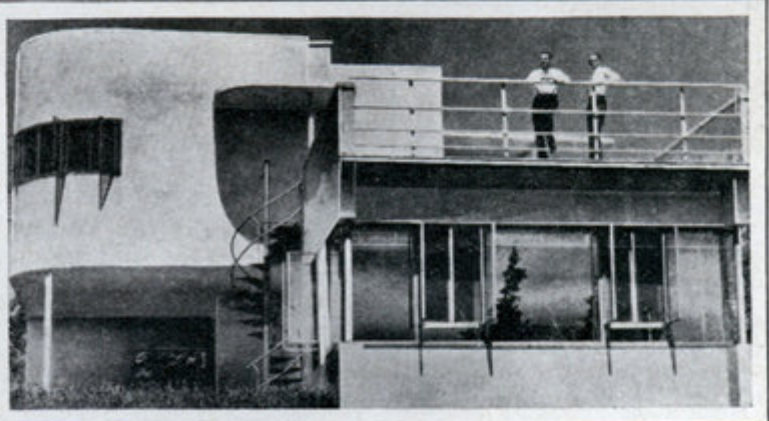
Artist's drawing shows outstanding features of the "House of Tomorrow."

convection and moisture evaporation to relieve the body of its excess heat.

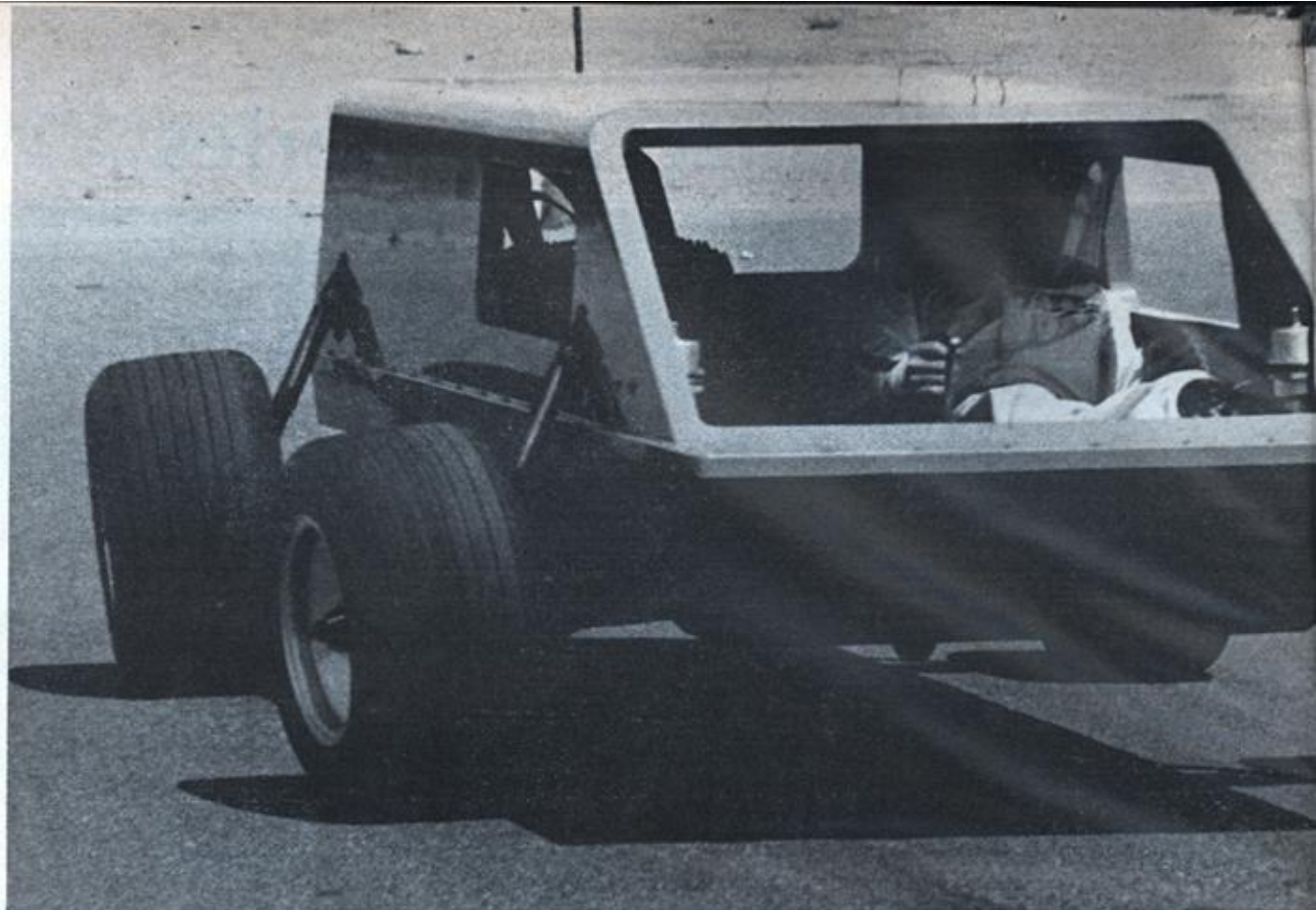
Experiments showed that with 80 degree walls and 60 degree air current circulating through the room, the artificial climate is very invigorating and productive of the last word in comfort.

Contributions of architects to home convenience amounts to a wholesale scrapping of all our cherished housing ideas. The

(Continued on page 31)



Though fantastic in design, this modernistic home of glass and steel greatly surpasses conventional homes in comfort and healthfulness. Note the deck-like platform which does duty as a front yard. Flood of sunlight for illumination enters through the ample windows, bettering health and cutting light bills. Photo courtesy Howe and Lescaze, Architects, New York City.



Cornering attitude of Box when race-track tested is flat, no lean or pitch—but all wheels adopt curious camber angles, and rear

"The Box"—All Wheels Steer

Look at this ultralight on-and-off-road vehicle that hits new highs in mobility

By JIM DAVIS / PS West Coast Editor

Racing car? Economy car? Dune buggy? Off-road vehicle? The answer, every time, is yes; the Box is all of these. It began life as a multipurpose car suitable for street, track, and off-road use; but because it has a fully watertight body, it even converts to an amphibian when paddles are fixed to the wheels.

The designers, Dan Hanebrink and Matt Van Leeuwen of Costa Mesa, Calif., aimed for aircraft lightness. They also had their own ideas on just about everything in the chassis department.

A radical departure. The Box is far from the norm. But when you analyze it, you see the thoughtful reasoning and the simplicity behind the design: four-wheel drive as well as four-wheel

steering; power by a rear-mounted motorcycle engine, and belt drive to transmit the power. With the two-stroke, 500cc, 60-hp Kawasaki engine, the Box will top 100 mph and do the standing quarter-mile in 13.5 seconds at 95-mph terminal speed! A four-stroke LaVerda engine is now being tested.

From the engine, power is transmitted to the rear differential via a pulley. Suspension is an independent swing-axle affair, front and rear. It utilizes a hydropneumatic nitrogen-oil system, with separate reservoirs for each wheel. Over rough terrain this system really proves itself, taking the bumps out of ruts and gullies, and making off-road driving almost comfortable.

There is no separate frame. The body structure is what holds the parts together. The body is made in two sections, a top and bottom, bolted together. The Box is a two-seater. You step into it through a single front door, which also serves as the windshield.

The Box is made of balsa wood (the ultralight stuff you build model

planes of) and fiberglass (the kind used in big aircraft). The balsa, end-cut into small pieces, is fitted between layers of the fiberglass.

Although aircraft fiberglass is harder to work and requires more attention to detail, it gives greater strength. Using this balsa/glass sandwich construction made it possible to strengthen points exposed to the greatest stress—such as suspension mountings—without beefing up areas that don't need it.

Controls for the Box. They're simple—borrowed from motorcycle components. Gear-changing is managed with the right hand, and so is the clutch control. The left hand controls the throttle by a twist-grip arrangement, as used on motorcycles. Brakes are applied simply by pushing the throttle grip forward.

You steer with your feet. It sounds weird, but really isn't. It's like the steering on those soap-box carts you had as a kid. When you pushed with your right foot, the cart turned left. When you pushed with the left, you turned right. But in the Box, instead of pushing directly on the axle, you



wheels show a pronounced steering angle!

and Drive

are operating a hydraulic four-wheel steering system. The surprising thing to the designers was that it proved easier to make than a conventional two-wheel mechanical steering gear and linkage.

When can you buy? Plans call for about half a dozen of the Boxes to be built by the end of the year. A team of them will be entered in the Mexican 1000 off-road race this winter. They'll still be experimental. After that, start watching for yours. **23**

"THE BOX" SCORE

Wheelbase	77 in.
Track (front and rear)	68 in.
Overall length	144 in.
Overall width	80 in.
(w/tires)	
Overall height	40 in.
Ground clearance	8 in.
Steering	Closed-loop hydraulic
Suspension	Swing axles front and rear, with hydro-pneumatic struts
Wheels	13 x 10
Tires	5.75/12.80-13
Dry weight	700 pounds
Transmission	Uniroyal belt drive
Engine	3-cyl. Kawasaki 500 or 2-cyl. La Verda 750.



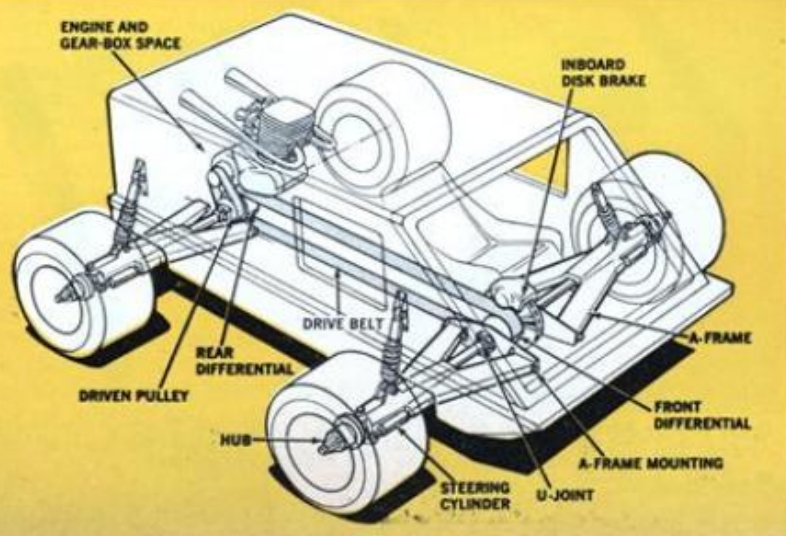
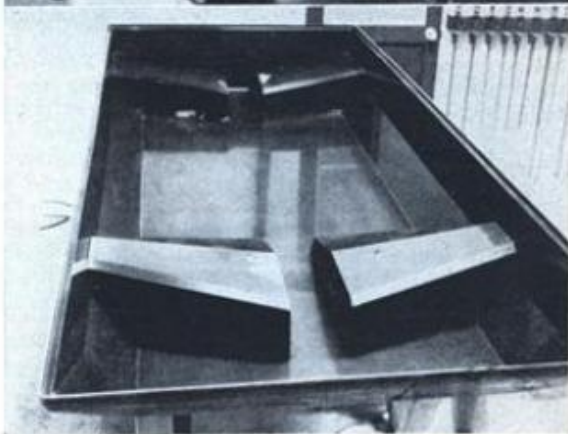
You steer with your feet, use hand controls of motorcycle type for throttle, clutch, gear-

box. Driving the Box, Davis discovered, is no stranger than anything else about it.

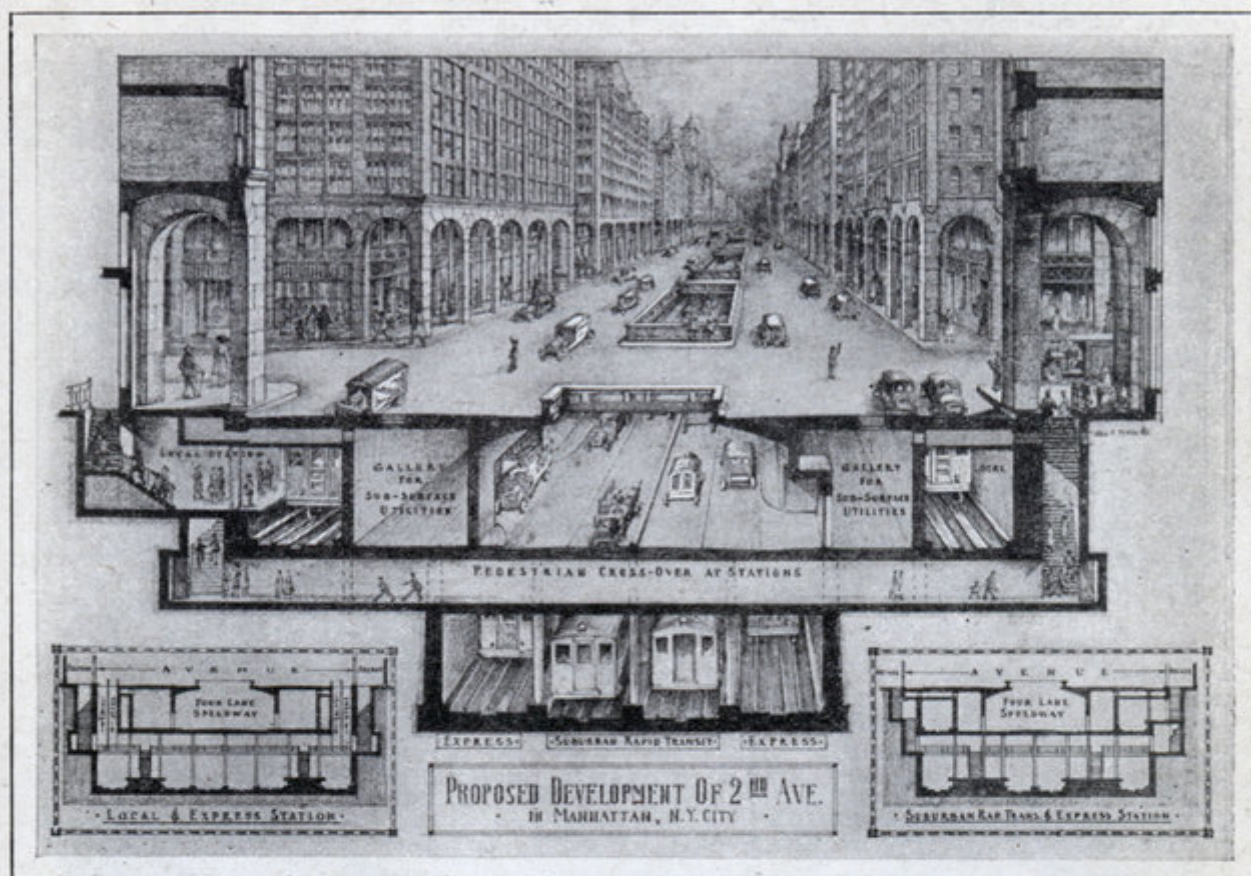
Top section is made of end-cut pieces of balsa wood sandwiched between fiberglass and molded. Door (which holds windshield) and windows are cut out after molding.



Fiberglass bottom mold shows great tightness of the supporting structure with total lack of seams, joints, or bonds. The raised areas in the floor pan form the covers for the suspension control arms. Sketch below clarifies transmission and suspension principles, and shows the unique disk brake that is mounted inboard.



2-Level Streets to SPEED TRAFFIC



This artist's sketch illustrates the two-level highway to be built in New York for relief of traffic congestion. Through traffic will travel on the four-lane speedway between the local subway tracks.

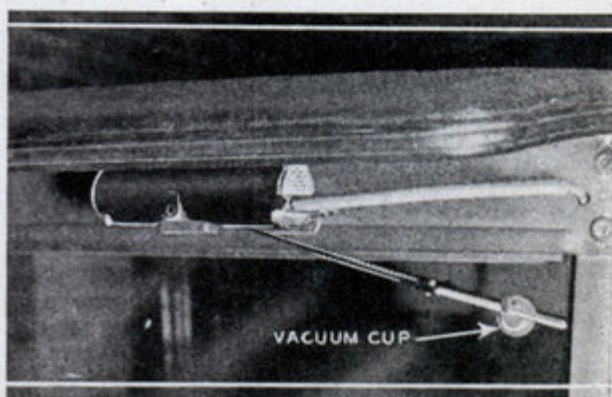
A DEFINITE step towards the relief of traffic congestion on much travelled city thoroughfares by the construction of streets under streets is soon to be taken by the city of New York. When this stupendous project has been brought to completion the metropolis will have an underground lane for fast through traffic, a tunnel for local and express trains, all built underneath the surface street, which will be left for local traffic.

Extending down Second Avenue from the Harlem river, the roadway will greatly improve circulation in Manhattan. The plan proposes a four-lane roadway and a pavement 20 feet below the present street level. Local rapid transit tracks will be placed beneath the service roadways, with ramps and escalators making them easily accessible to the streets.

On the surface the existing sidewalks will be placed in pedestrian arcades within the buildings lining the streets. Ventilation will be provided by openings in the street center, as illustrated in the drawing above.

Vacuum Cup Holds Shield Wiper

DURING a day's driving, windshield wiper blades must be adjusted many times. A simple method to eliminate this slipping is furnished by the new vacuum cup holder, shown in photo below. The blade runs back across the hook and stays in position without working down, doing away with necessity for adjustment.



Adjustment of wiper blade is unnecessary with vacuum cup holder, which keeps blade in position.

AMBULANCE RADIO controls traffic

AMBULANCES are supposed to speed people to hospitals—but they can't speed and they therefore can't save some lives.

Traffic holds them back. Their average 35 mph is pretty slow.

But they may do 70 before long. A device now being patented by

J. R. Schwarzkopf will put a radio transmitter in the ambulance. Traffic lights will contain tuned receivers with relays. The ambulance will streak along, its radio signalling—and all the lights will turn red and all traffic pull over to clear an open speedway. •



40 Years in the Future

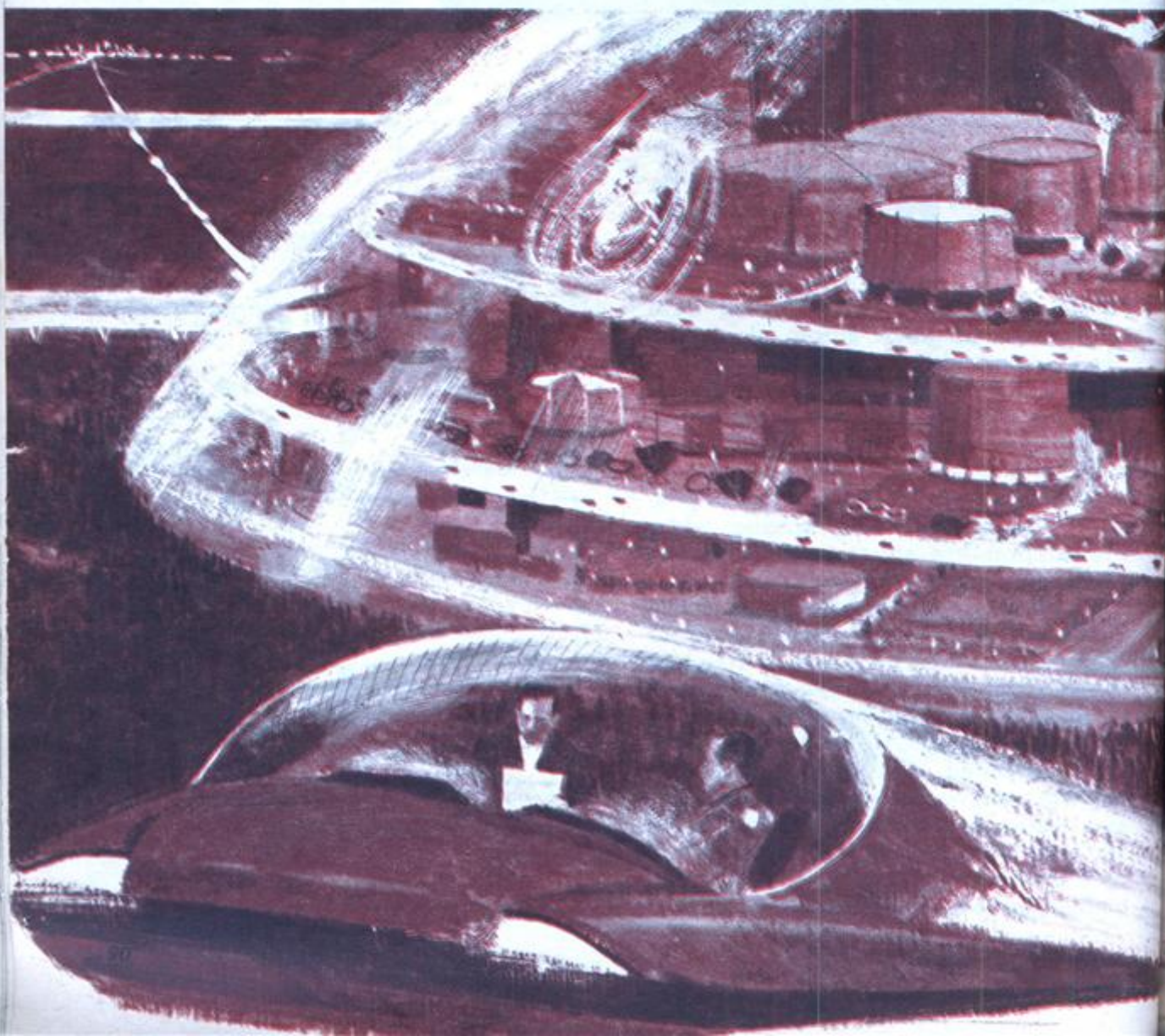
By James R. Berry

IT'S 8 a.m., Tuesday, Nov. 18, 2008, and you are headed for a business appointment 300 mi. away. You slide into your sleek, two-passenger air-cushion car, press a sequence of buttons and the national traffic computer notes your destination, figures out the current traffic situation and signals your car to slide out of the garage. Hands free, you sit back and begin to read the morning paper—which is flashed on a flat TV screen over the car's dashboard. Tap-

ping a button changes the page.

The car accelerates to 150 mph in the city's suburbs, then hits 250 mph in less built-up areas, gliding over the smooth plastic road. You whizz past a string of cities, many of them covered by the new domes that keep them evenly climatized year round. Traffic is heavy, typically, but there's no need to worry. The traffic computer, which feeds and receives signals to and from all cars in transit between cities, keeps vehicles at least

VEHICULAR travel between the domed, evenly climatized cities of 2008 is controlled by



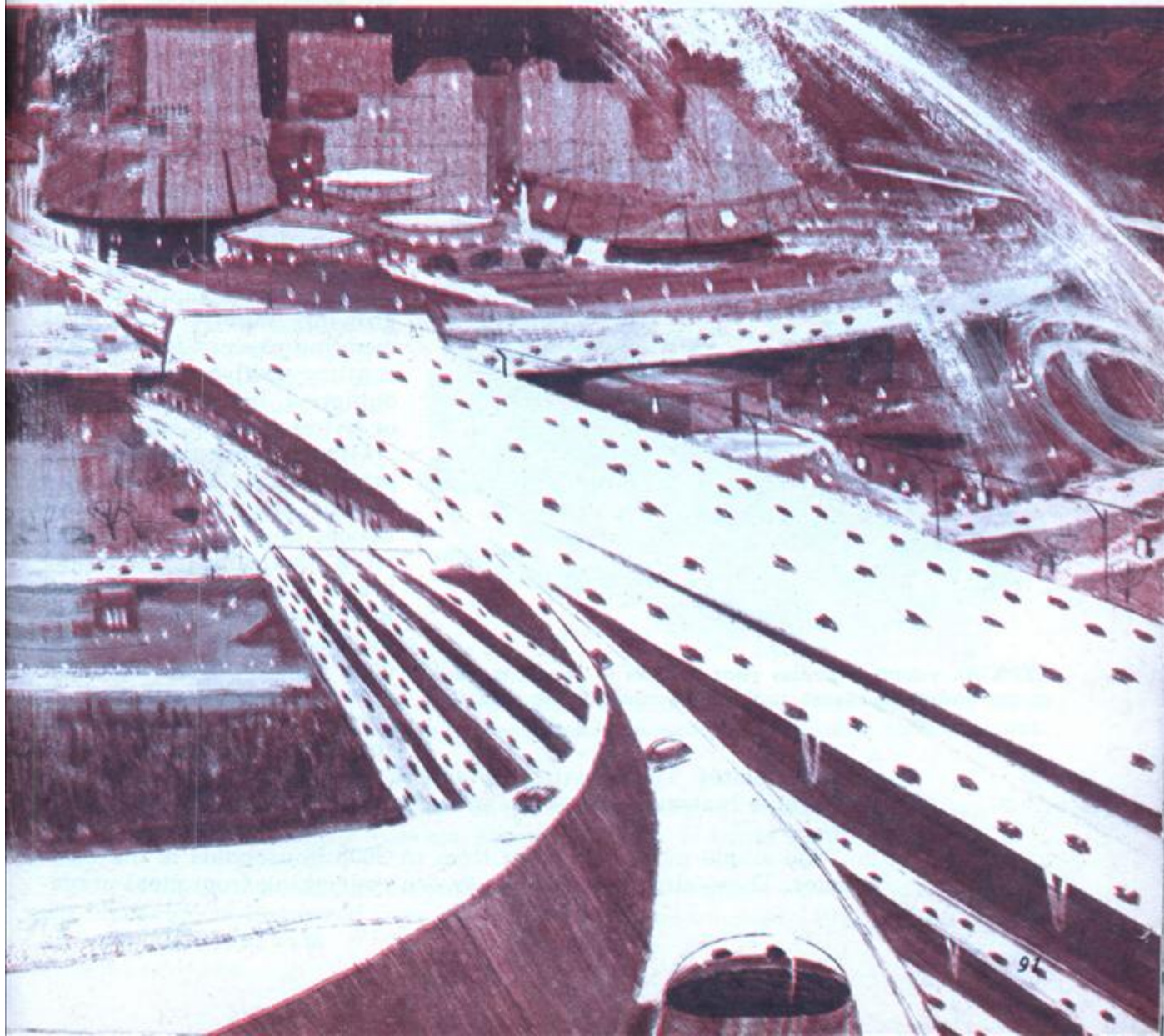
50 yds. apart. There hasn't been an accident since the system was inaugurated.

Suddenly your TV phone buzzes. A business associate wants a sketch of a new kind of impeller your firm is putting out for sports boats. You reach for your attache case and draw the diagram with a pencil-thin infrared flashlight on what looks like a TV screen lining the back of the case. The diagram is relayed to a similar screen in your associate's office, 200 mi. away. He jabs a button

and a fixed copy of the sketch rolls out of the device. He wishes you good luck at the coming meeting and signs off.

Ninety minutes after leaving your home, you slide beneath the dome of your destination city. Your car decelerates and heads for an outer-core office building where you'll meet your colleagues. After you get out, the vehicle parks itself in a convenient municipal garage to await your return. Private cars are banned inside most city

the national traffic computer, which guarantees perfect safety even at speeds of 250 mph.



40 Years in the Future

cores. Moving sidewalks and electrams carry the public from one location to another.

With the U.S. population having soared to 350 million, 2008 transportation is among the most important factors keeping the economy running smoothly. Giant transportation hubs called modemixers are located anywhere from 15 to 50 mi. outside all major urban centers. Tube trains, pushed through bores by compressed air, make the trip between modemixer and central city in 10 to 15 minutes.

A major feature of most modemixers is the launching pad from which 200-passenger rockets blast off for other continents. For less well-heeled travelers there are SST and hypersonic planes that carry 200 to 300 passengers at speeds up to 4,000 mph. Short trips—between cities less than 1,000 mi. apart—are handled by slower jumbo jets.

Homes in MF's 80th year are practically self-maintaining. Electrostatic precipitators clean the air and climatizers maintain the temperature and humidity at optimum levels. Robots are available to do housework and other simple chores. New materials for siding and interiors are self-cleaning and never peel, chip or crack.

Dwellings for the most part are assembled from prefabricated modules, which can be attached speedily in the configuration that best suits the homeowner. Once the foundation is laid, attaching the modules to make up a two- or three-bedroom house is a job that doesn't take more than a day. Such modular homes easily can be expanded to accommodate a growing family. A typical wedding present for the 21st century newlyweds is a fully equipped bedroom, kitchen or living room module.

Other conveniences ease kitchenwork. The housewife simply determines in advance her menus for the week, then slips prepackaged meals into the freezer and lets the automatic food utility do the rest. At preset times, each meal slides into the microwave oven and is cooked or thawed. The meal then is served on disposable

plastic plates. These plates, as well as knives, forks and spoons of the same material, are so inexpensive they can be discarded after use.

The single most important item in 2008 households is the computer. These electronic brains govern everything from meal prepa-



TYPICAL vacation in the year 2008 is to spend a week at an undersea resort, making excursions via minisub.

ration and waking up the household to assembling shopping lists and keeping track of the bank balance. Sensors in kitchen appliances, climatizing units, communicators, power supply and other household utilities warn the computer when the item is likely to fail. A repairman will show up even before any obvious breakdown occurs.

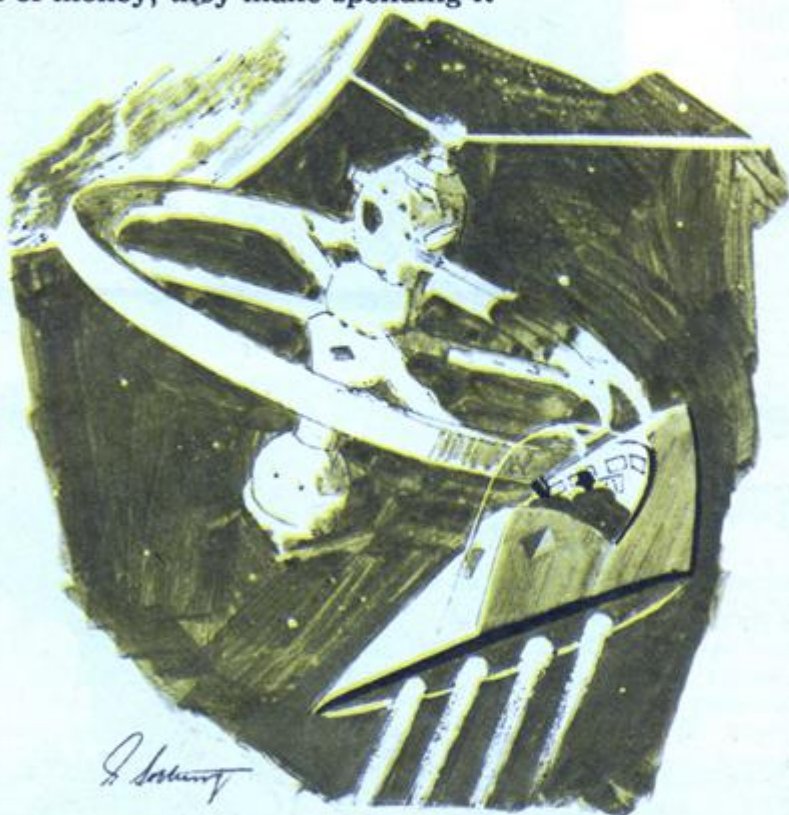
Computers also handle travel reservations, relay telephone messages, keep track of birthdays and anniversaries, compute taxes and even figure the monthly bills for electricity, water, telephone and other utilities. Not every family has its private computer. Many families reserve time on a city or regional computer to serve their needs. The machine tallies up its own services and submits a bill, just as it does with other utilities.

Money has all but disappeared. Employers deposit salary checks directly into their employees' accounts. Credit cards are used for paying all bills. Each time you buy something, the card's number is fed into the store's computer station. A master computer then deducts the charge from your bank balance.

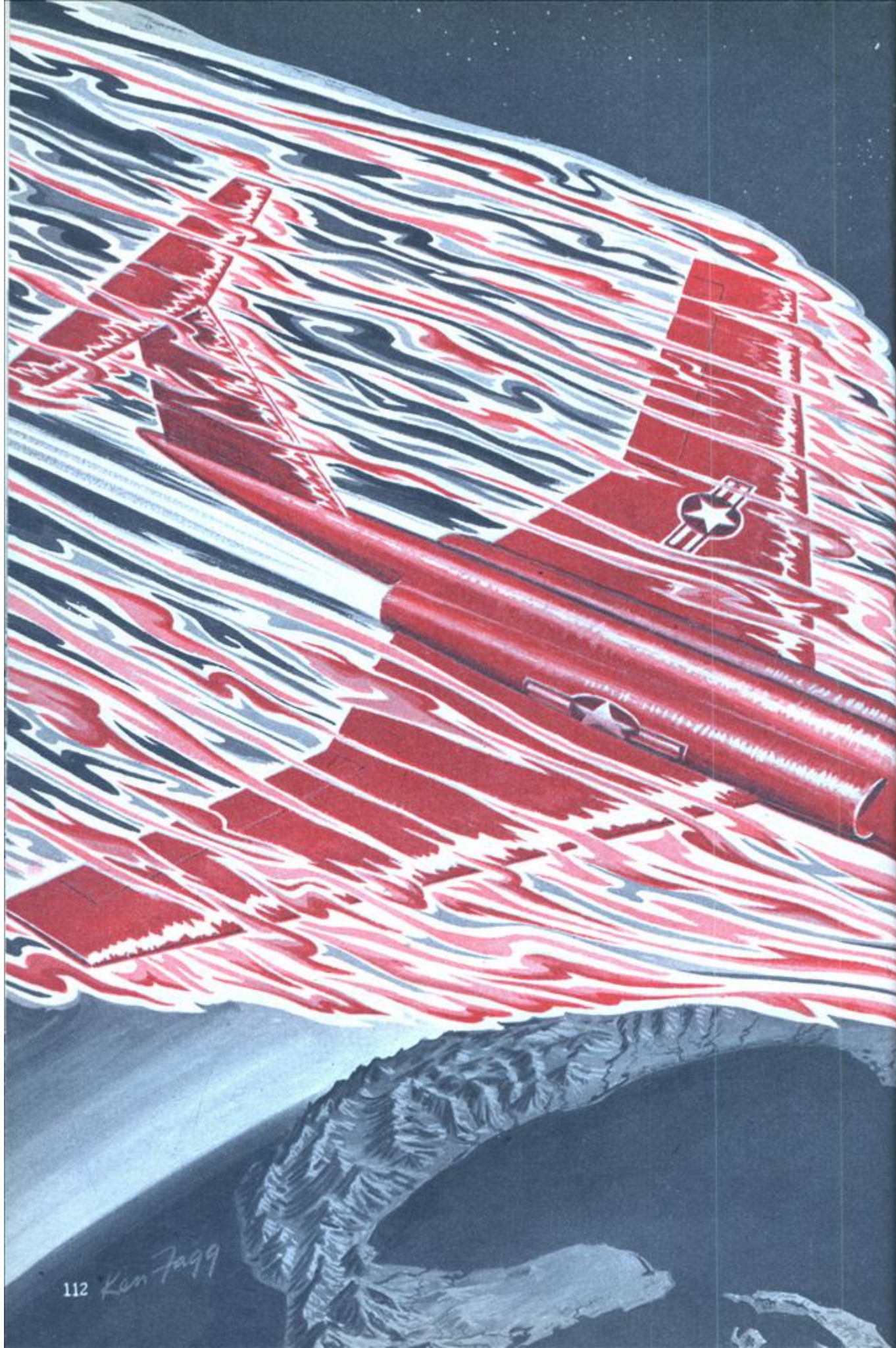
Computers not only keep track of money, they make spending it easier. TV-telephone shopping is common. To shop, you simply press the numbered code of a giant shopping center. You press another combination to zero in on the department and the merchandise in which you are interested. When you see what you want, you press a number that signifies "buy," and the household computer takes over, places the order, notifies the store of the home address and subtracts the purchase price from your bank balance. Much of the family shopping is done this way. Instead of being jostled by crowds, shoppers electronically browse through the merchandise of any number of stores.

People have more time for leisure activities in the year 2008. The average work day is about four hours. But the extra time isn't totally free. The pace of technological advance is such that a certain amount of a jobholder's spare time is used in keeping up with the new developments—on the average, about two hours of home study a day.

Most of this study is in the form of programmed TV courses, which can be rented or borrowed from tape [Continued on page 140]



ROCKET RIDE to hotel satellite, plus vistas of earth and moon, makes an equally memorable vacation jaunt.

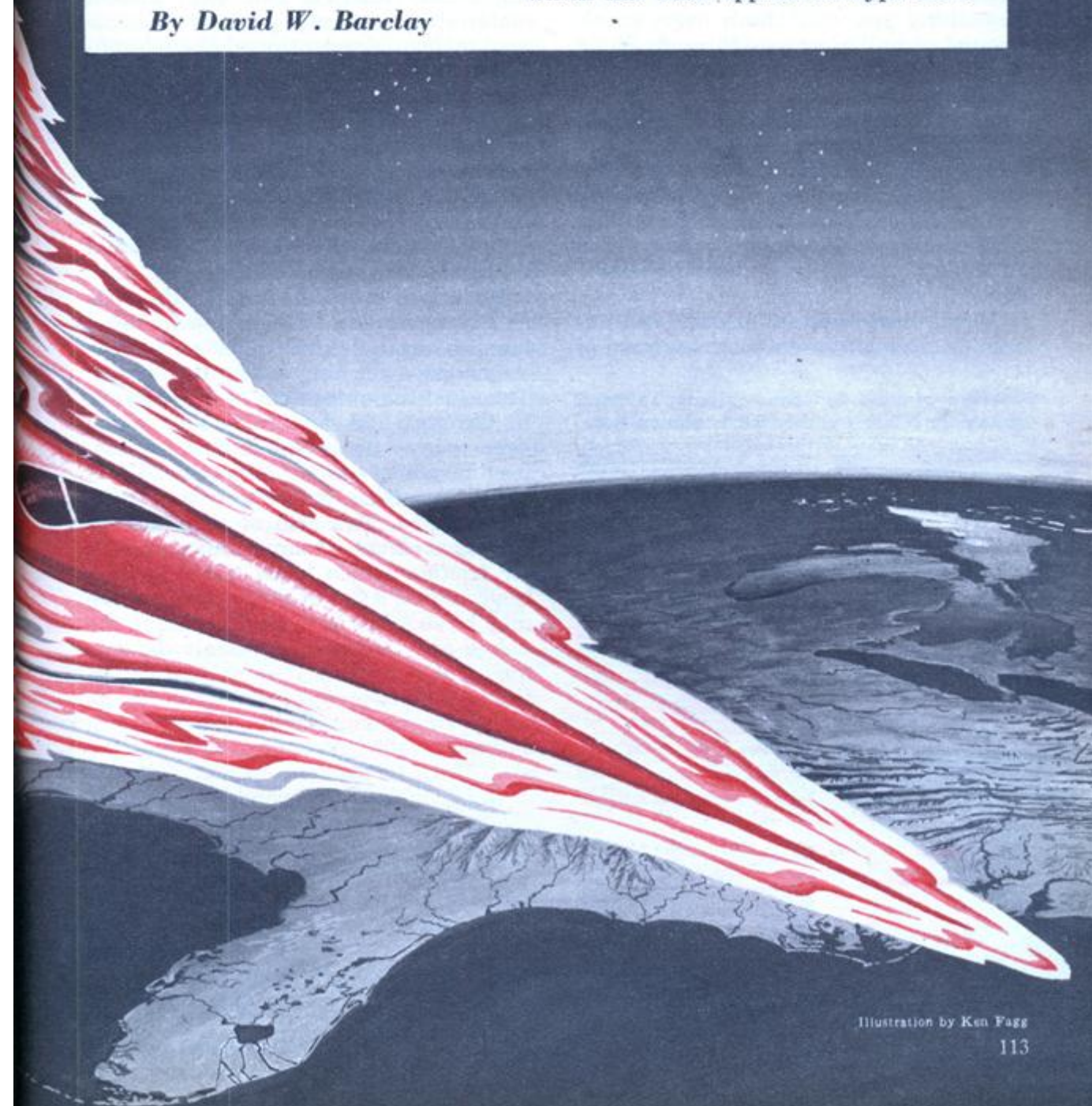


CAN WE CRASH THE DEADLY FLAME BARRIER?

*Fly a plane fast enough
and friction will melt it.
Can we "put out the fire?"*

By David W. Barclay

ENGINEERS, who sometimes get pretty irritated when writers dream up catch phrases for their scientific findings, are not exactly happy with the term Flame Barrier or Heat Barrier which has been applied to hypersonic



buckles. A very little "thermal buckling" inside a wing can render that wing unsafe for flight.

Power plants for high-Mach flight will eventually be rockets. Turbojet engines—notably the Pratt and Whitney J-57, an improved version of which is said to develop 16,000 pounds of thrust with afterburner on—have several limiting features. One of them is the inability of the high-speed turbines to withstand the heat. Another is size, fuel and weight limitations. If you build a turbojet engine big enough and powerful enough to push an airplane up to 3,000 miles an hour, the airplane becomes enormous. Worse than that, you have to carry so much fuel there's no room for payload. The whole operation becomes impractical. A ramjet engine is a better bet in some ways but it, too, has drawbacks.

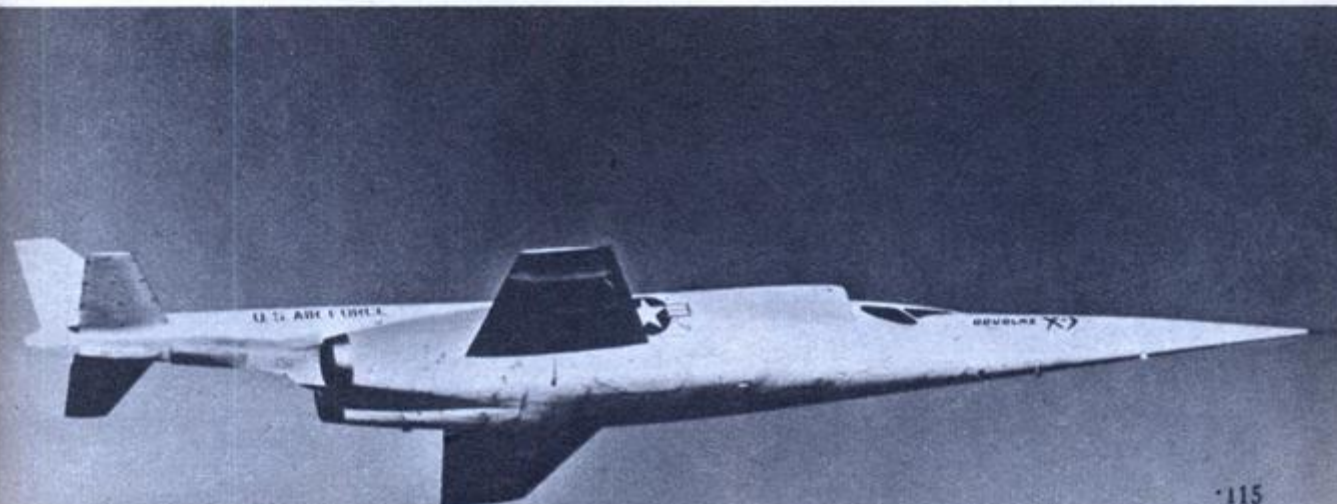
Rockets, which will work without any outside atmosphere, have many advantages. Bell Aircraft Company has done a great deal of research on rocket motors and has come up with an aluminum-alloy job which can be built quickly and cheaply out of standard alloys and uses a relatively plentiful and cheap type of rocket fuel—acid and standard JP-4 jet fuel. The Bell package has made runs of 10 minutes duration and some motors have logged an hour on power—which is a ripe old age for a rocket motor in any league. Bell can handle engines with 50,000 pounds of thrust in their laboratories at the moment—and 100,000 pound-thrust engines may be possible in

this lab in the not too distant future.

Rocket engines are admittedly hard to control. The best way at present seems to be to install four or five of them and use one at a time, as needed, conserving the rest. The thrust per pound of weight is fantastically good in a rocket—which is one of the main reasons why their future seems so bright in high-Mach flight. Bell experimental rocket planes have been flying for years at Muroc, where they have a tremendously long natural runway for power-off landings. Since it will not be possible to have these long runways commercially, some way must be found to shorten the landing roll of the rocket planes.

Sleek configuration of airplanes, with a minimum of knobs, fillets and other "stagnation points" is a must in hot speed flight. Tests have shown that burbling air is many times hotter than air which slides smoothly over the surface of the plane like a coat of invisible skin. Flying Saucers may not be real but they are certainly the best theoretical shape for really high speeds. The hottest spots on current airplanes are places where the air rams the airplane head-on—leading edges of wings, tail surfaces, fuselage nose, airscoops and the like. At tremendous speeds the plane backs air up well out in front of it—like a snowplow pushing a heavy drift—and the proof of this is the very long hypodermic-like needle which thrusts out of many high-speed planes. It's the tube for the air-

Tremendous heat generated at supersonic speeds poses problems in the latest high-speed aircraft like this needle-nosed Douglas X-3.



MECHANIX ILLUSTRATED®

15^c

November

Jet Pilots Fly In
Bed—Page 70

ROCHESTER, N.Y.—GOLD RUSH CITY FOR INVENTORS
COMPLETE PLANS FOR A 35-MPH OUTBOARD RACEABOUT

Jet Pilots Fly in Bed

THE United States Air Force is putting its flyers to bed so that they can't go to sleep!

If that seems sort of cryptic to you, be assured that it should. For it's only a complicated way of saying that a prone position bed for pilots to reduce the possibility of blackouts and ease the strain of sitting has been developed at the Aero-Medical Laboratory of the Air Materiel Command in Dayton, Ohio. Gravitational pull and flying fatigue are the pilots' worst enemies. During Air Force tests, flyers in the prone position withstood up to 12 g's without blacking out. Regularly seated pilots can take less than five g's.

This safety feature has an added advantage, too. Less space is required for the cockpit, thus permitting a slimmer silhouette on the plane itself. The reduction in drag permits much higher speeds.

The bed itself consists of a length of nylon netting, supported over specially constructed sides which conform to the body contours of the average pilot. The support can be adjusted to the individual by raising or lowering the netting under the pilot's abdomen. Strangely enough, tests have shown that thinner pilots require more support than plumper ones. Their flat abdomens don't provide enough support to keep the lumbar regions of their spines from sagging.

Special controls for the prone position have also been worked out. Two movable pans with adjustable handgrips act as levers for steering the plane. The pans are padded with foam rubber so they are comfortable over long periods of time. They're also adjusted so that control movements are not affected by high gravitation forces.

A padded jaw supports the flyer's head and a counter-weighted headrest further relieves strain on his neck. Then, there's a leg separator which gives each lower leg



Greater fuselage streamlining, above, makes prone-pilot jet look like a guided missile. Below is similar view of XF-90 with pilot in upright position. Armament area below pilots is same in both models.



its own support. This avoids the tendency of the inner surfaces of the legs to sweat and it prevents pressure on the inner surfaces of the knees. Feet are braced against adjustable pedals which serve as rudder and brake controls.

Latest word on this prone position pilot bed is that it was installed in the nose of a B-17 for test purposes and was also tried out in the forward part of an F-80 jet craft. And you can bet the Air Force hasn't dropped the matter there.

One of these days you'll be seeing a slim, rocket-like jet plane zooming over the horizon. Then, you can nudge your neighbor and slyly say: "There goes a bed-ridden jet!" •



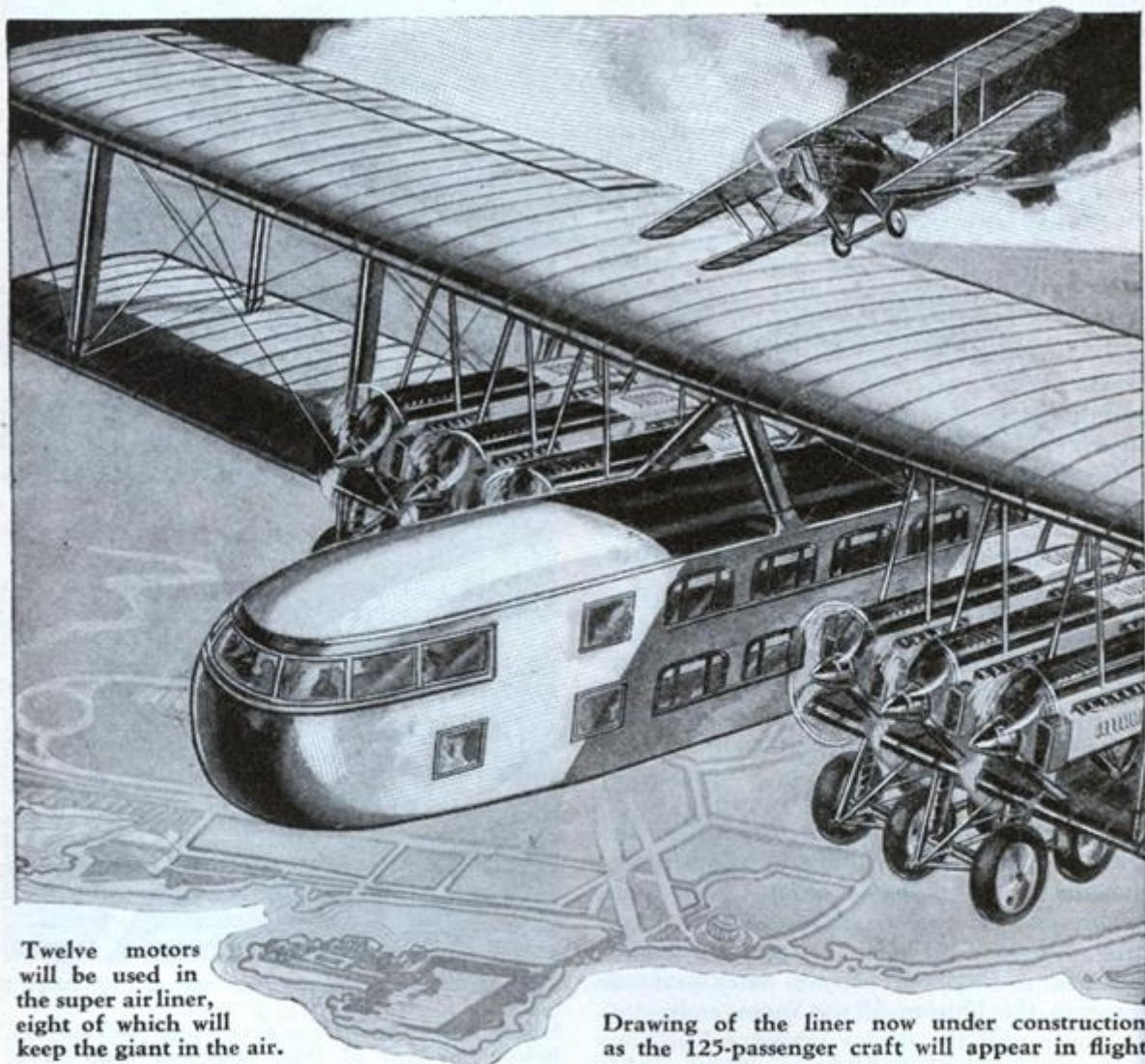
Here's one of the prone position pilot beds which was developed by the Air Materiel Command.



COVER STORY

Sectional view of the prone pilot bed superimposed on conventional jet fighter shows the radical reduction in diameter of the fuselage which would be possible. Armament is air-to-air missile launcher.

Building AMERICA'S



Twelve motors will be used in the super air liner, eight of which will keep the giant in the air.

Drawing of the liner now under construction, as the 125-passenger craft will appear in flight.

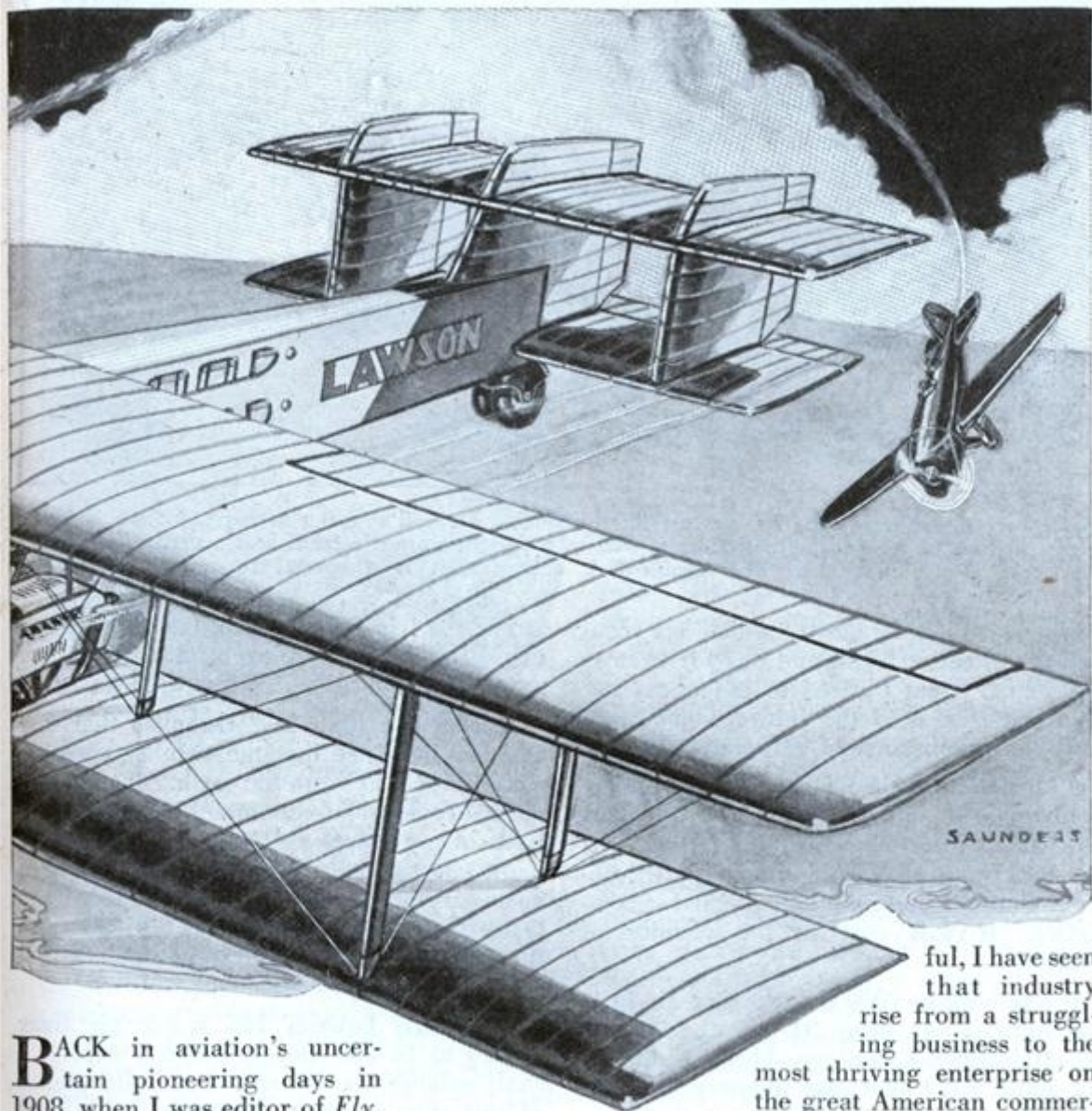
Alfred W. Lawson, pioneer figure in aviation, who built the first commercial cabin passenger plane and the first tri-motored ship with heated cabin and sleeping berths, reveals to *Modern Mechanics* readers his plans for a 125-passenger air liner weighing 50 tons which he is now building in his New Jersey factory.

EDITOR'S NOTE: Known as one of aviation's keen-visioned pioneers, Alfred W. Lawson is one of those few men who, back in the earliest days of flying, dared to look into the future and predict that the day was coming when giant ships of the air would carry passengers comfortably, safely, and swiftly to destinations throughout the world. Not content with mere pre-

diction, he has been quietly working out the design of a gigantic passenger airplane which will be the largest in America when completed. In this interview, one of the very few he has ever accorded, he reveals interesting facts concerning his past and present work in aviation, and explains in detail features of his huge 125-passenger air liner.

Largest Plane

As told by
ALFRED W. LAWSON
Famous Airplane Designer
to ALFRED ALBELLI



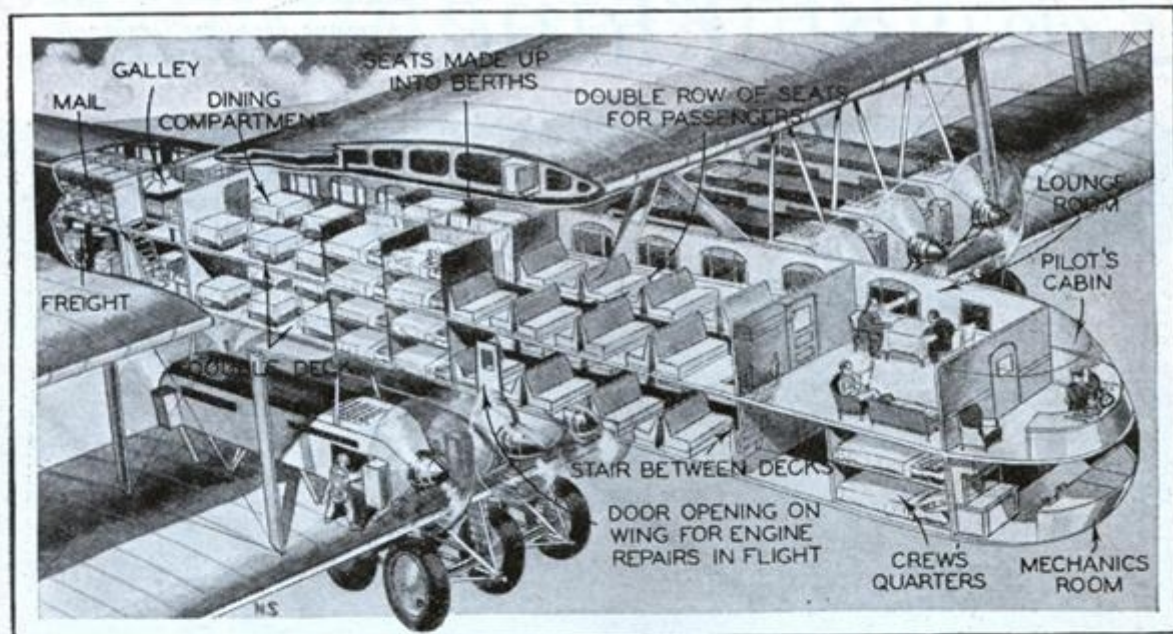
BACK in aviation's uncertain pioneering days in 1908, when I was editor of *Fly*, then the national aeronautical magazine, I was regarded as a prophet of doom. The general public, which is always skeptical at the appearance of engineering innovations, sneered and scoffed at my forecasts for flying. Everywhere I was regarded as a crank. It is a wonder I wasn't condemned to the stake for witch-craft, now that I reflect on turbulent days that have gone.

During the twenty-two years that I have now completed in the field of aviation, sticking tenaciously and doggedly to my theories and principles through periods of time when the future of aviation seemed doubt-

ful, I have seen that industry rise from a struggling business to the most thriving enterprise on the great American commercial scene. Today, no less enthusiastic in my belief in aviation than I was twenty-two years ago, I am the advocate of the air-liner. My disciples are legion, at this time, however. The *Graf Zeppelin's* round-the-world flight, the incarnation, so to speak, of one of my ideas, has demonstrated that my ideas are not so fantastic as they once were thought to be.

Rarely have I come from behind the scenes to be interviewed for publication. My mission and my work in aviation has at all times been that of the quiet producer. On this occasion I have been induced to enter the limelight for a brief moment in

Double-Tier Decks Unusual Feature of This Giant Air Liner's Design



Interior arrangements of the Lawson air liner include seats and sleeping accommodations for passengers in case of long distance flights, as well as a freight storage section and a mail room where letters are sorted in flight. The double-deck arrangement is a special feature of the liner.

the interests of the industry which has occupied my attention night and day for twenty-two years. I am pleased to tell about my super air liner and the future which is in store for this branch of aeronautics.

At the present time I am building in my factories at Trenton, New Jersey, an enormous double-tier super air liner which will carry 125 passengers. It is only partly finished and will require another year for completion. It will cost in the vicinity of \$500,000.

It was back in 1909 that the first air liner was born in my brain. I saw the idea in the crude Bleriot fuselage. However, it was not until 1919 that the industry had developed sufficiently to allow me to build an air liner. During those intermediate ten years my mind was thinking about big, practical air carriages. At the same time I was quietly accumulating the knowledge and experience necessary to build them.

In 1919 I first demonstrated the practical usage of the air liner in a successful flight from Milwaukee through New York City to Washington and return, personally acting as captain and navigator, and with nothing but a map, a compass and my sense of direction for guidance. On August 27, 1919, without any advance notice, I covered the first

lap of the trip from a point ten miles north of Milwaukee to Chicago, a distance of more than 100 miles, in less than an hour.

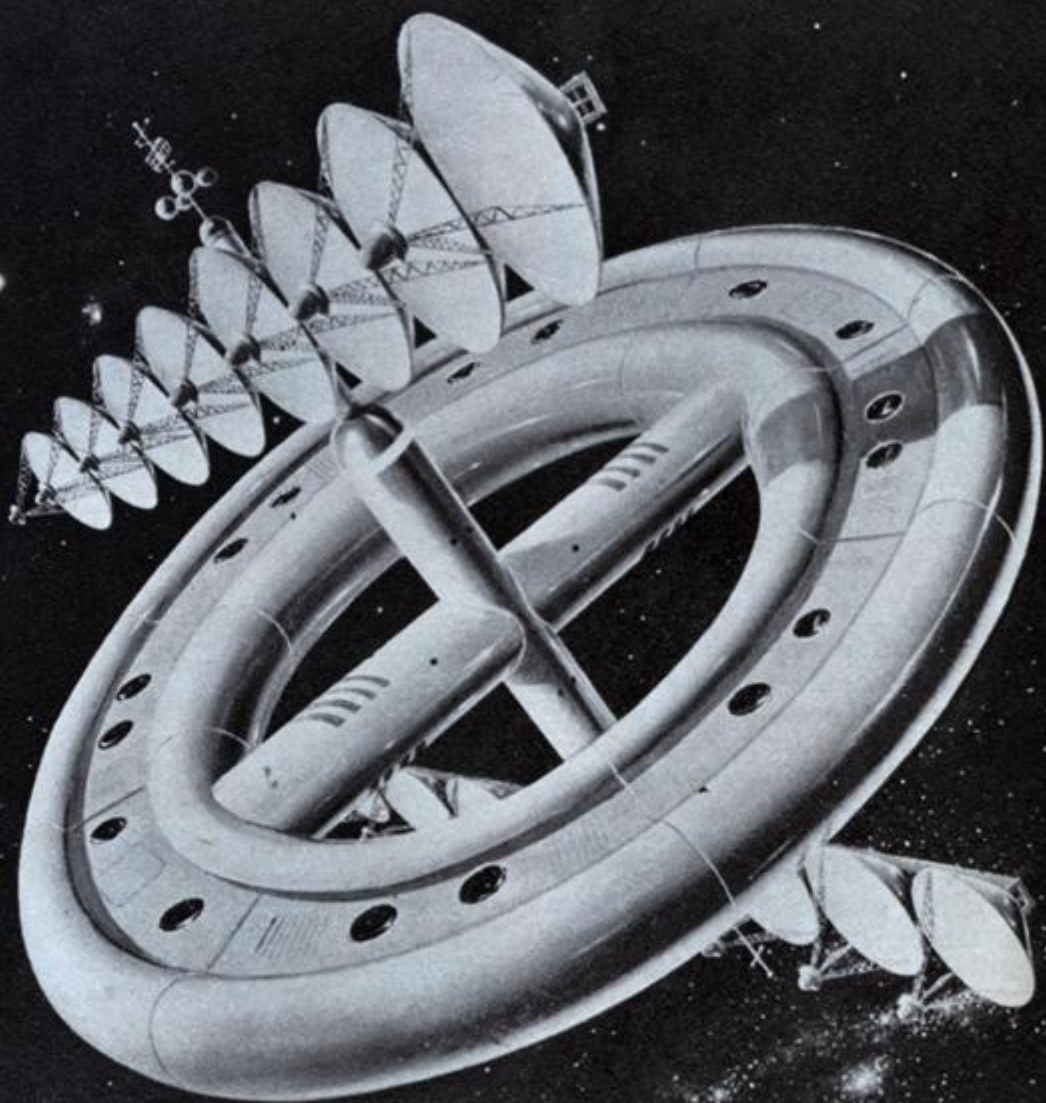
Betting ran high in Milwaukee that day and few imagined that the weighty machine would ever soar from the earth. They called me a drunkard of dreams. But today I sit back in my offices at 1819 Broadway, New York City, and during odd moments there flash across my mind the spectacles of my types of commercial airplanes flitting across the American and European continents—all dreams which have come true.

When the Lawson 125 seater air liner proves to be the success which I expect, I shall enlarge my factories and build planes of this type in mass production. We will be able to turn them out as fast as flivvers once we get started.

In the latest Lawson air liner now under construction, the front section of the cabin, rounded out to reduce wind resistance, will be devoted to the pilots and mechanics. Two pilots will sit up front at the dual controls. Beneath them space has been provided for the mechanics. They will remain there until some emergency makes it necessary for them to crawl out on the wings to the motors.

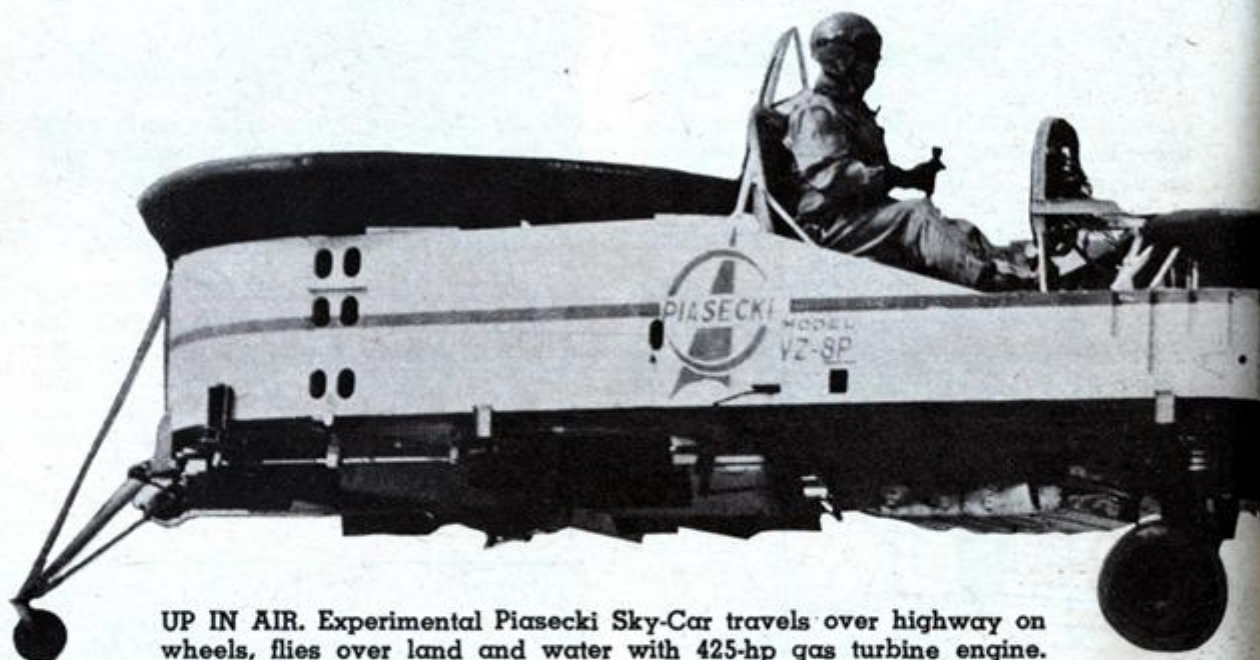
On either side of the cabin and half-way

IT'S NEW



ORBITING at fixed 22,000-mile altitude, four manned space stations like this one may ultimately link all of the world's major cities with live television and microwave radio communications, according to RCA engineers.

These SKIMMERS *Go Anywhere*



UP IN AIR. Experimental Piasecki Sky-Car travels over highway on wheels, flies over land and water with 425-hp gas turbine engine.



JET FUEL is used to power the Sky-Car which combines the advantages of a land Jeep with those of a small helicopter, claims Piasecki.

THE Wright boys would blink in astonishment at some of the weird rigs taking to the air these days. Air-Cars, Sky-Boats, Flying Jeeps, Hovercraft—they're revolutionizing the Age of Flight.

Most of these craft are based on two new devices: the ducted fan and the air cushion.

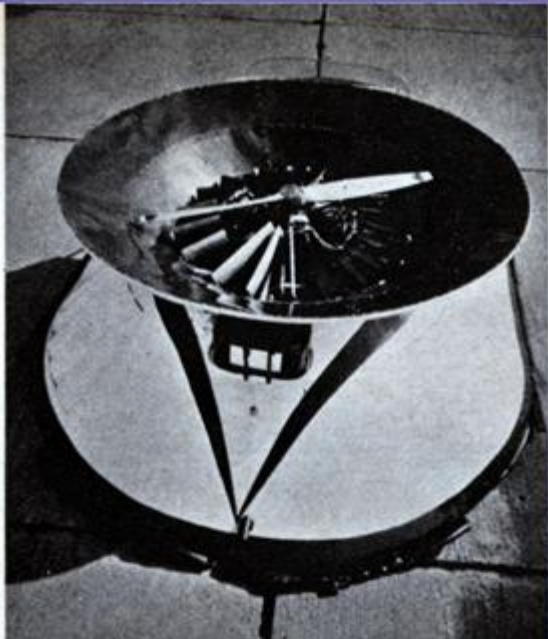
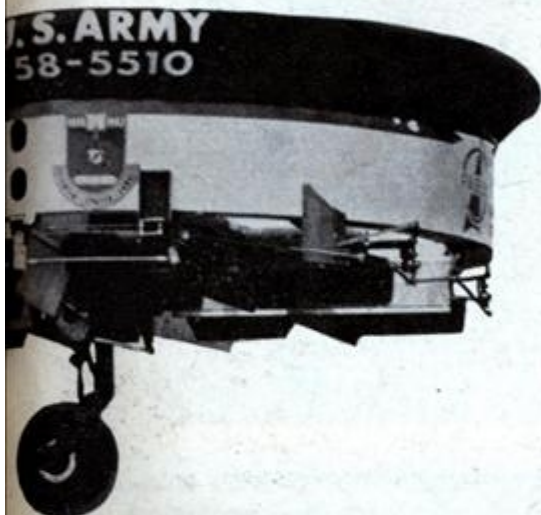
The ducted fan is simply a horizontal prop that supports the vehicle on a column of air. Forward movement is provided by slanted vanes.

With the air cushion, air under pressure is forced downward, raising the vehicle a few inches above the ground or water.

Here are a few of the latest skimmers to come off the drawing boards. •



SKY-CAR has flown at 30 feet. Ultimate aim is to have craft achieve 150 mph speed in air, 30-40 mph as a wheeled land vehicle.



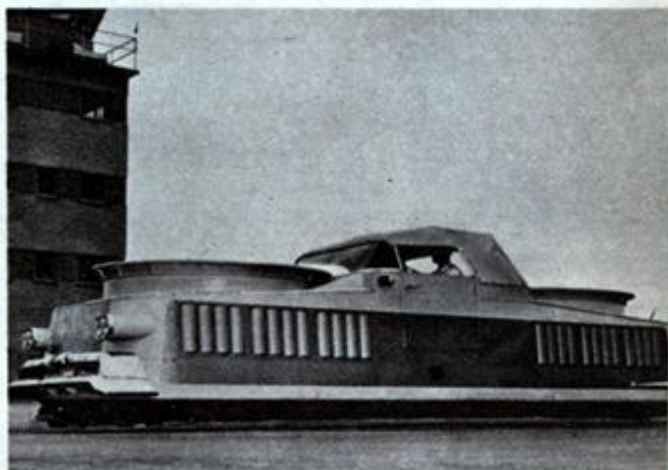
EXPERIMENTAL skimmer developed by the Curtiss-Wright Corp. can use conventional type piston engine of from 50 to 200 hp.



AIR-CAR lifts itself from 6 to 12 inches off the ground. The Curtiss-Wright prototype model can travel in any direction.



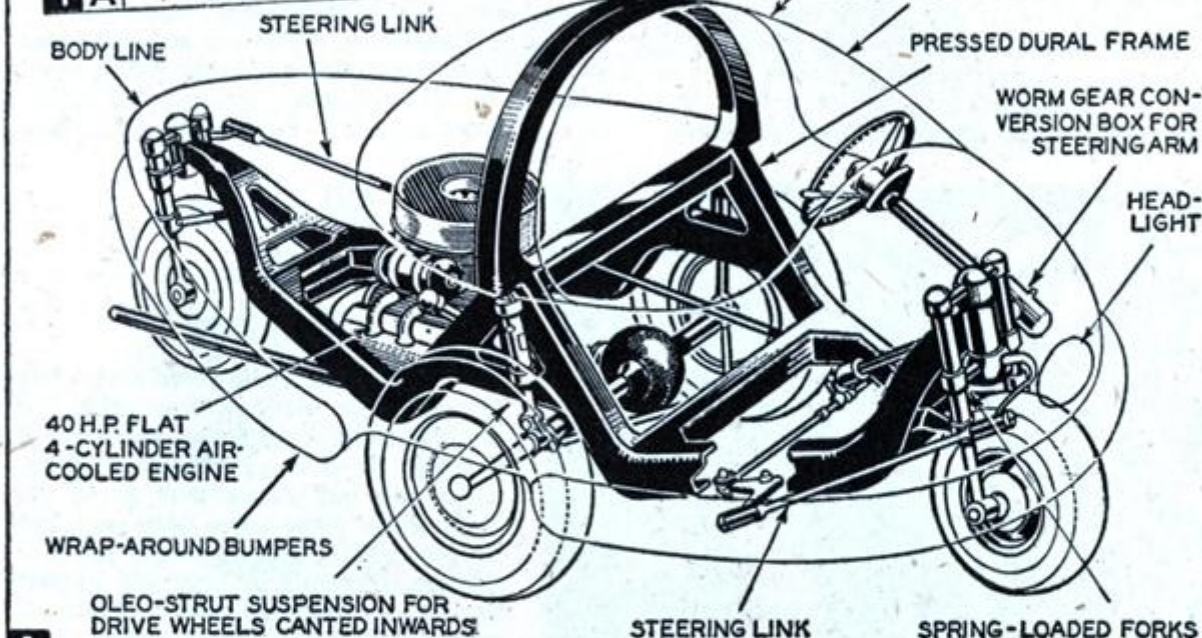
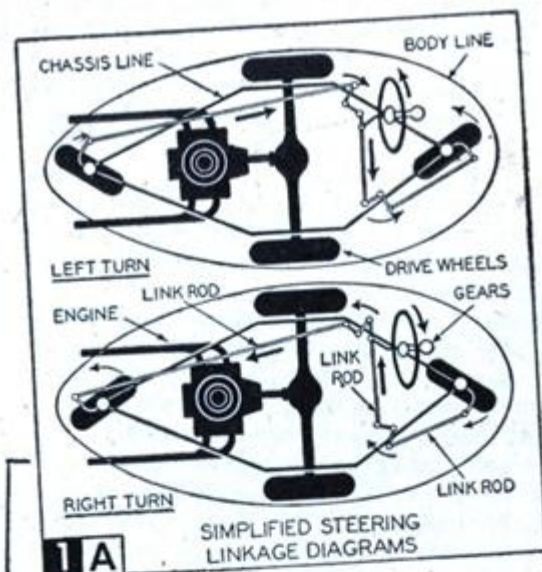
SKIMMER is U.S. Navy test job that rides on an inch-thick cushion of compressed air delivered via flexible hose along sides.



NEW MODEL four-passenger, 300 hp Air-Car is scheduled to go into production this fall at Curtis-Wright South Bend plant.

Readers Suggest Some *New* Car Designs

Small teardrop car designed by John Lipanovich has Duralumin frame for lightweight strength; all-around visibility through plastic bubble for safe visibility. Pivoting wheels (above) turn the Quadra-Pod 440 on its own axis.



FREIGHT space, refrigerated bodies, and enough heft to roll over in a crash and come up running, are what the designers of these automotive candidates in S&M's Better Car Design series want in their cars. Yet plainly they want them in a variety of shapes and sizes.

With this installment, **SCIENCE AND MECHANICS** continues the series on reader car designs inaugurated with the simply conceived Shay 150 (Aug. '56 S&M) and carried on with the unorthodox Chemobile (Oct., '56 S&M).

These designs (which aren't necessarily endorsed by our editors) tackle some of the problems of auto planning in similar ways, but split off on widely divergent paths in solving others.

For John Lipanovich (of San Francisco) 40 hp is enough to push his teardrop Quadra-Pod (Fig. 1) but Ralph H. Dellevie, Jr., Pass-A-Grille Beach, Fla., wants a good 200 hp under the hood of his Sportsman (Fig. 2). Yet both have

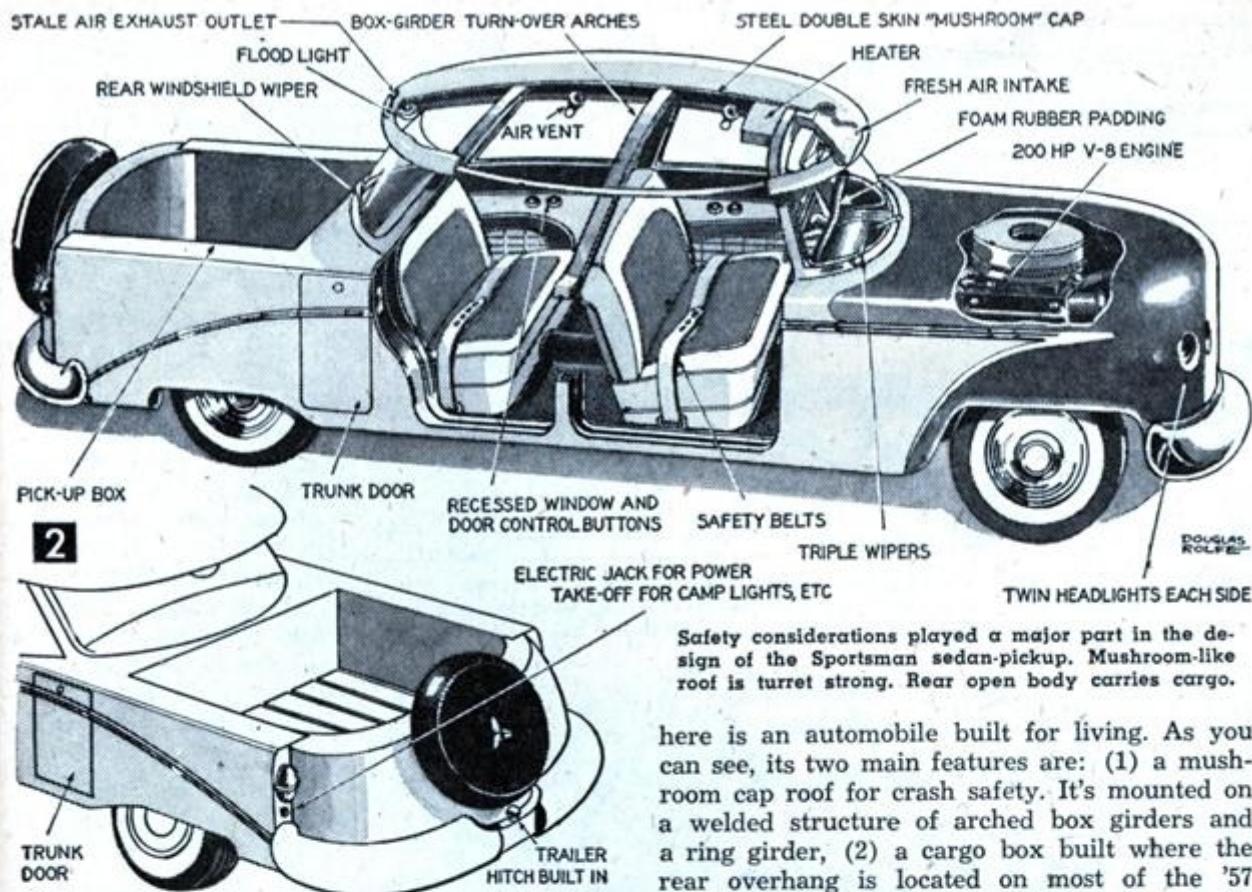
mounted vault-strong roofs overhead for roll-over protection.

And while the overall designs of Alfred J. Clemens' sedan-pickup and Dan Barshak's Dream Car sportster are as far apart as Paris and Pomona, there is similar thinking behind Clemens' one-piece hood and fenders and Barshak's one-piece removable top.

For a full understanding of the cars though, take a walk around each one, giving it the close scrutiny of a car on the showroom floor:

Quadra-Pod 440. A lightweight but sturdy Duralumin frame with integral turn-over arch makes this small car unusually rugged (Fig. 1). The curved contours of the pod body give bonus strength too.

For in-town driving the 440 really shows its mettle. Wraparound bumpers wrap clear around the machine to buffet blows from all directions. Pivoting front and rear balloon wheels let the



car turn on its axis to sashay clear of collisions in heavy traffic.

Lean down on the nose or tail of the 440 and notice how it jounces back up. That's because of the motorcycle-style fork suspension. Airplane-style shock-strut suspension springs the drive wheels. On turns the car banks like an airplane.

Power? The two-seater gets plenty from its 40-horsepower, flat-four-cylinder engine carried under the rear deck behind the seats.

Step into the coupe through one of its sliding doors and settle back into a bucket seat. Front, back, above, all around there's full visibility through the tinted plastic canopy. Steering might be a little problem until you get used to it (Fig. 1A), but with that transparent bubble on all sides you're not likely to hit anything.

All in all, the Quadra-Pod could be a mighty safe car. In fact, it bears an almost family resemblance to a 500 pound, flatiron-shaped safety car suggested in 1952 by French inventor Gabriel Voisin (first man to install a gasoline engine in an airplane).

Sportsman. Take one look at this big car (Fig. 2), and you know that

Safety considerations played a major part in the design of the Sportsman sedan-pickup. Mushroom-like roof is turret strong. Rear open body carries cargo.

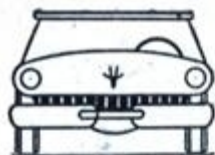
here is an automobile built for living. As you can see, its two main features are: (1) a mushroom cap roof for crash safety. It's mounted on a welded structure of arched box girders and a ring girder, (2) a cargo box built where the rear overhang is located on most of the '57 models. With the tailgate up, length for cargo is six feet; down, eight feet.

Restricted visibility should never be a problem with this car. Glass completely surrounds you on all sides, but the overhang of the mushroom roof acts as a sun shade and deflects snow and rain. When weather gets really bad though, four electric wipers, three on the windshield, one behind, whisk the windows clean.

Things should never get stuffy in the Sportsman, either. Notice that complete heating-ventilating system built into the double-skin roof. Fresh air is taken in through a front grill under the roof's brow, out of the way of rain and snow, then through ducting between the roof layers and into heaters (in cold weather) also within



DETROIT DESIGNS ONE, TOO. Ford's new Ranchero (remindful of the Sportsman and Pickar) is a car with a pickup truck-type space in the rear. Payload for the vehicle is three-quarters of a ton. Load space covers full width of car. Spare tire and luggage slip behind seat. Horsepower options are 144, 190, 212.



LIFT-UP PORTS FOR CHECKING WATER AND OIL, ETC.



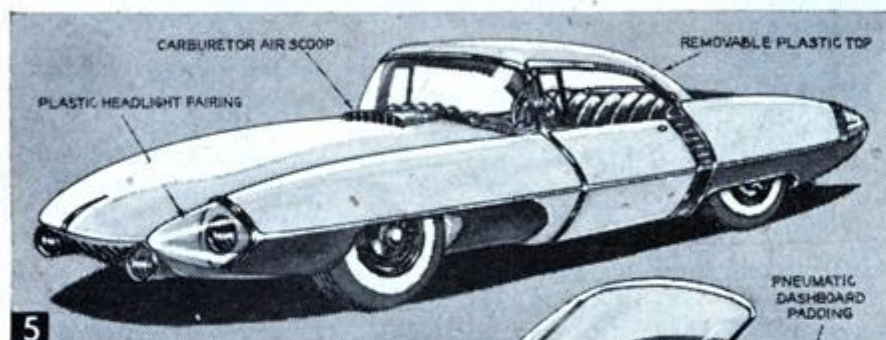
HOOD AND FENDERS RAISE AS SINGLE UNIT

TARPAULIN COVER

TAIL GATE

4

Alfred J. Clemens' (Detroit, Mich.) version of the sedan pick-up, the Pickar, gives consideration both to the home-mechanic who wants to fix his own car and to the suburbanite or rural dweller with freight to haul.

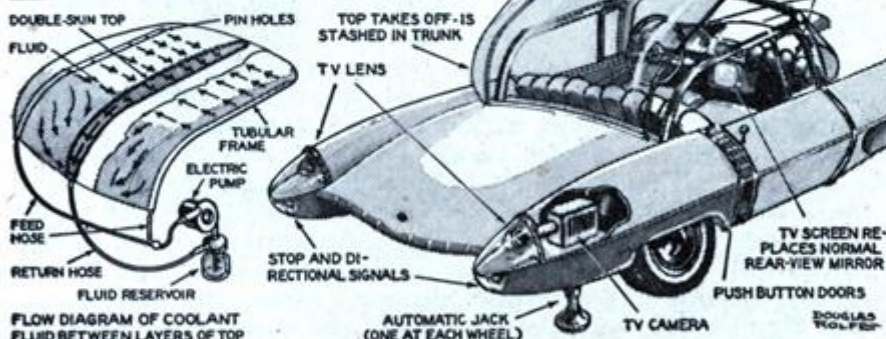


CARBURETOR AIR SCOOP

PLASTIC HEADLIGHT FAIRING

REMOVABLE PLASTIC TOP

5



DOUBLE-SKIN TOP

FLUID

PIN HOLES

TOP TAKES OFF - IS STASHED IN TRUNK

TV LENS

TUBULAR FRAME

ELECTRIC PUMP

FEED HOSE

RETURN HOSE

FLUID RESERVOIR

FLOW DIAGRAM OF COOLANT FLUID BETWEEN LAYERS OF TOP

STOP AND DIRECTIONAL SIGNALS

AUTOMATIC JACK (ONE AT EACH WHEEL)

TV CAMERA

TV SCREEN REPLACES NORMAL REAR-VIEW MIRROR

PUSH BUTTON DOORS

Even the headlamps are faired sharply into fender lines in an attempt to give the Dream Car perfect streamlining. Coolant circulates in transparent roof.

the roof. Stale air exhausts through a vent at the rear of the mushroom roof.

And consider all the other features: (1) A jumbo rear-view mirror 18 in. wide for a big view behind; (2) Red warning light and buzzers on each gage to signal poor operating conditions; (3) Full padding throughout; (4) A jack outlet for plugging in lights, appliances, and tools; (5) Concealed cleats for cinching down cargo ropes; (6) Insulated interior panels made of washable plastic in colored wallpaper-style designs; (7) carpets of washable colored rubber; and (8) A 200-horsepower V-8 engine with a compression ratio of 8.5:1 that still can be run on regular gas.

fenders; the one-piece clamshell hood and fenders which lift as a unit, and the cutout ports for checking water, oil, and other engine areas.

Dream Car. From one extreme to another, look over the low, lunging shark-shape of this sports roadster (Fig. 5) laid out by Dan Barshak, Bay Shore, Long Island, N. Y. That removable top is a two-layer, transparent sandwich. When the sun beats down on it, a filling of liquid coolant flows between its layers, carrying away heat.

For vision to the rear backward-pointing television cameras and a dash screen take the place of rear-view mirrors. Costly ideas, there! Extensive interior padding, including pneumatic cushions on the dash, are installed to prevent injuries.

Finally, before you leave the Sportsman notice its snappy paint job. Units would be shipped to the dealer with only the rust-protective first coat of paint, you can pick exactly the color scheme and pattern you like.

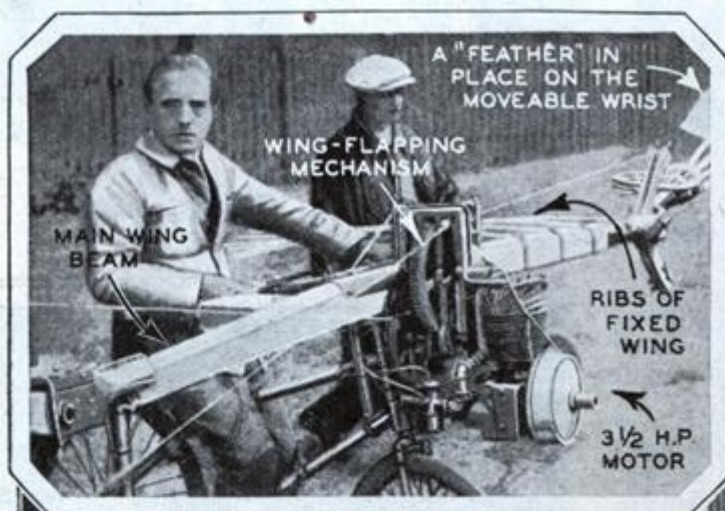
That such combination car-pickup units are not strictly dream-stage automobiles is demonstrated by the newly-announced Ford Ranchero shown in Fig. 3.

Pickar. Here's another machine (Fig. 4) that was built for going over rough or smooth roads, while toting everything from fertilizer to fancy-dressed guests from the city. It has a lot in common with the Sportsman, but the emphasis here is on work—both with the car and on it.

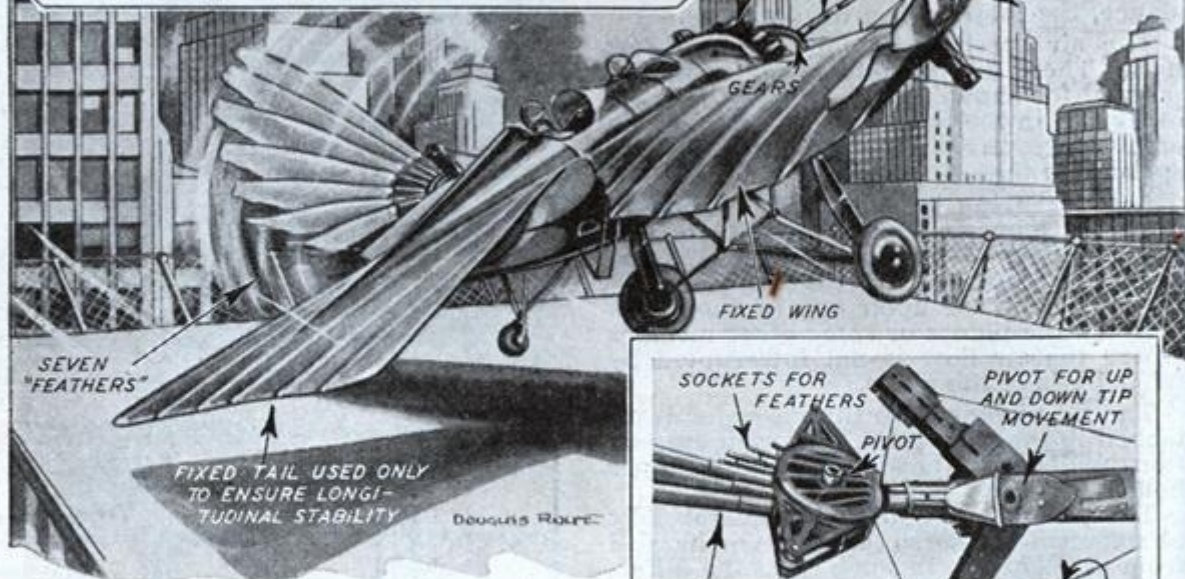
For the professional man, businessman, sportsman, and farmer, its rugged cargo space makes an ideal pickup for hauling any kind of less bulky freight. And like the Sportsman, that freight space makes the Pickar an ideal vacation car since it can haul a lot of luggage. Covered with a tarpaulin and fitted with some kind of pads it would make a good sleeping place for a couple of campers.

Working on the car is made easier by such niceties as the cutout

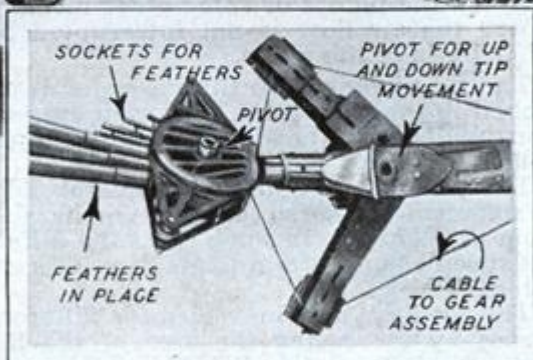
Why Wing-Flapping PLANES Won't Fly



At the left is shown Carl Czerny testing his experimental rig. It is claimed that the machine was easily lifted in tests.



Above is an artist's conception of a wing flapping plane of the type described here. At the right is a photograph of the "wrist" or link which connects the moveable and fixed wings. It is this "wrist" which imparts a rowing motion.



THE odd plane described here is just another manifestation of the wing-flapping idea which has cropped up periodically ever since man first considered the conquest of the air.

There is a certain brand of inventor obsessed with the idea that the only satisfactory way to achieve flight is by a literal application of bird-flight principles. To this class of inventor all present day aircraft appear completely unsatisfactory particularly in their use of airscrews rather than wing beats as a means of propulsion.

As a matter of fact, if the wing-flapping theory is tenable it would be just as logical to throw all modern boats into discard and replace them with ships driven with some sort of fin arrangement which followed closely the fish method of propulsion.

It is true that the study of bird flight has been of great value in the development of

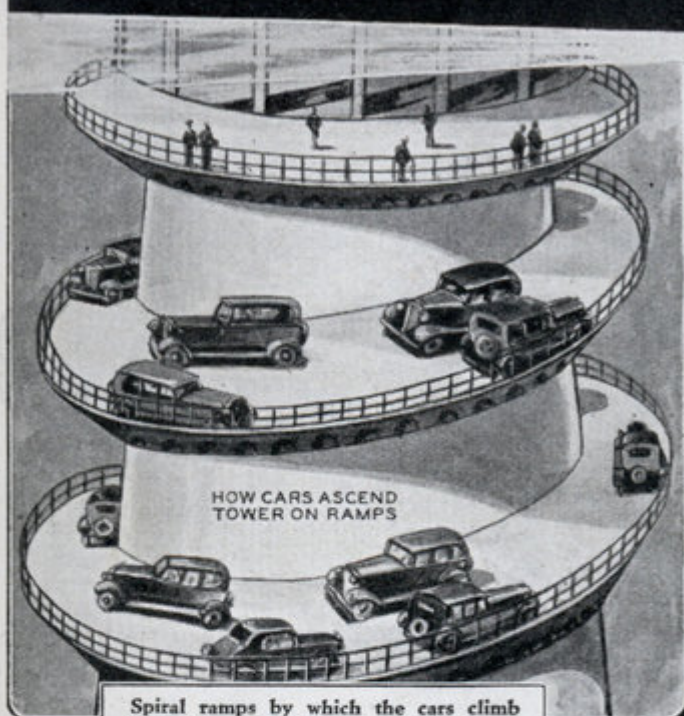
human flight and it is probably equally true that man has still much to learn from this study, but the results of this study have shown, and possibly will continue to show, that the wing-flapping type of aircraft is not likely to be developed.

Even a superficial study of birds shows that most of the larger species are primarily not wing flappers, but soarers, and it is from this latter class that most of the beneficial knowledge has been obtained and applied to airplane design. All attempts of inventors to produce a practical wing flapping craft have signally failed, but apparently this is a class not easily discouraged.

One of the more promising developments in this line of aircraft is now being completed in Austria. The inventor, Carl Czerny, produced several working models before the war and was working on a full size

(Continued on page 178)

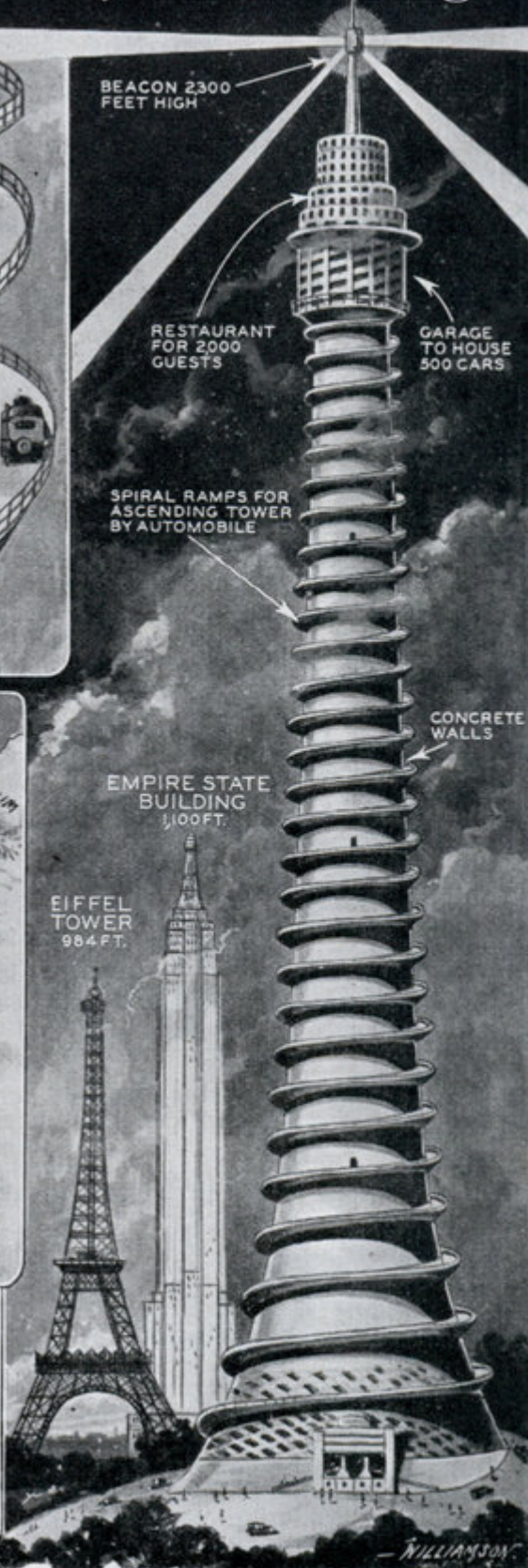
Pleasure-Tower Half Mile High



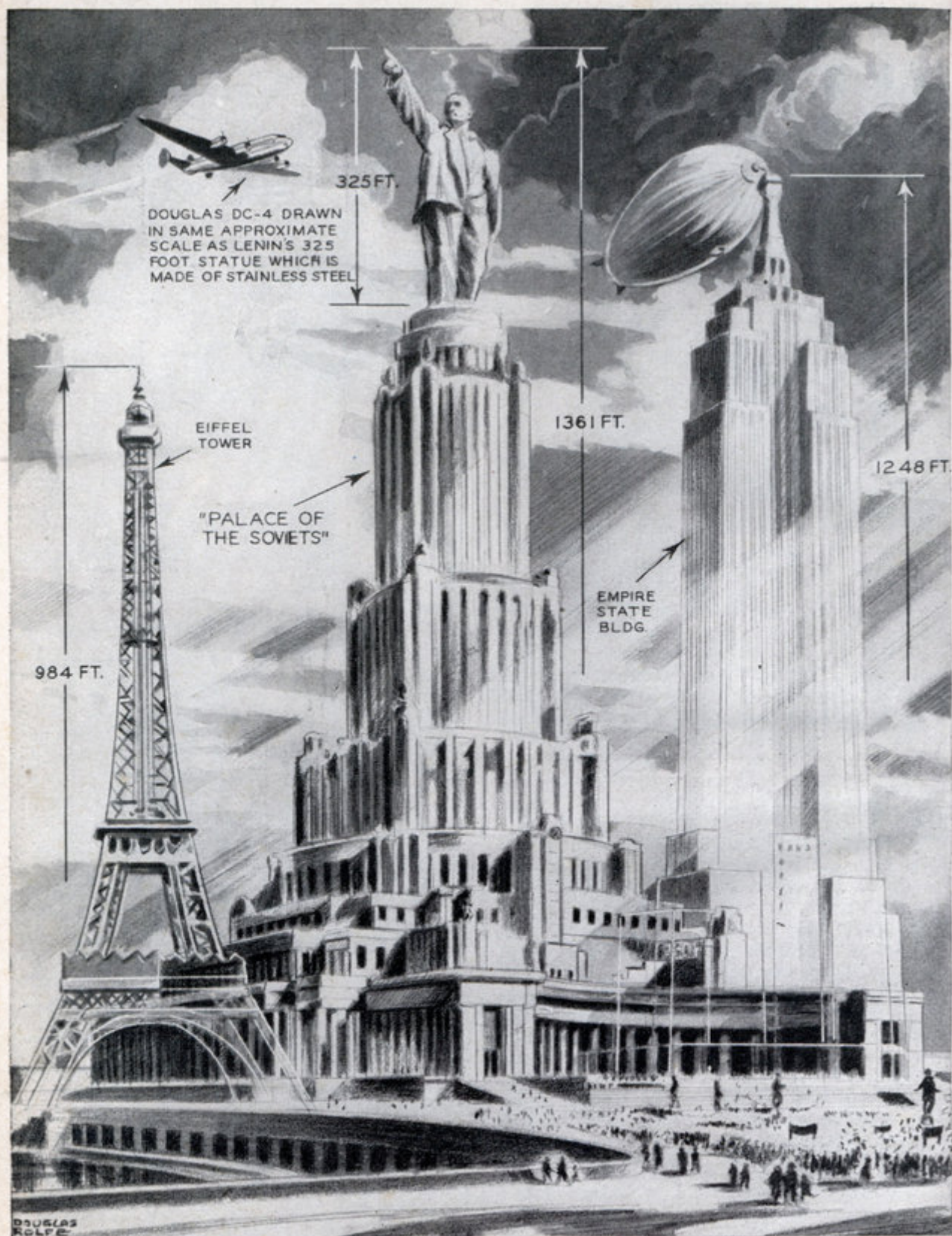
Spiral ramps by which the cars climb the tower will be supplemented by a series of elevators within the structure.



Towering almost half a mile above the ground, dwarfing such gigantic structures as the Empire State Building and the Eiffel tower, a huge concrete tower 2300 feet high, surmounted with a beacon and built with a spiral ramp for autos to climb up its sides, stuns the imagination with its vastness. It is the design of the French engineer, M. Freyssinet, intended for the 1937 Paris Exhibition. He estimates the cost at less than half the Eiffel Tower, or in the neighborhood of \$2,500,000. It will be called the "Phare du Monde," or Lighthouse of the World. The project appears far removed from the visionary and a new all-time "high" in buildings seems in a fair way to be achieved.



WORLD'S TALLEST BUILDING



In this drawing, the artist has shown how the "Palace of the Soviets," now under construction in Moscow, will compare in height with the Empire State building, in New York City, at present the world's tallest structure, and with Europe's tallest, the Eiffel Tower in Paris. The Palace of the Soviets will be completed in 1942 and, including the stainless steel statue of Lenin on top, will be the world's tallest and most spacious building. The main hall will seat 25,000 and another hall will seat 6,000. The ceiling of the interior dome will be 300 feet high. The building will be serviced by 120 elevators, 60 escalators, and will contain halls, clubs, galleries, museums, and will house government archives.